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ABSTRACT

One of 11 guides intended for use at the junior high school level of career exploration, the primary focus of the teacher's guide is on the many occupational opportunities within the transportation cluster. Four occupational clusters are treated: (1) land transportation, (2) water transportation, (3) air and space transportation, and (4) conveyance transportation. The guide offers: (1) a broad listing of occupational opportunities, (2) information needed to understand the work area, (3) instruction in recognizing economic trends, and (4) specific job descriptions. Job analyses include physical skills, health hazards, job locations, licensing requirements, training, age requirement, wages, educational requirements, working conditions, and advancements. Each unit specifies a unit purpose and objectives and includes an outline of unit, teaching-learning activities, evaluation techniques, and suggested resources. Related instructional materials accompany each unit and include reference lists, transparency masters, and other instructional materials. The appendix lists publishers addresses. (MW)

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EXPLORING CAREERS

IN

TRANSPORTATION ;

A GUIDE FOR TEACHERS

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July 1974

Field Test Copy

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PREFACE

Career education may be described as a program of systematic educational experiences which prepares students for economic independence and personal fulfillment. Such a program should focus on the development of knowledge, general and specific abilities, and the awareness of the values of a work-oriented society; assisting all individuals--at all educational levels and ages--to interact with the economic sector.

Career education includes vocational training, but it is more than this. It aims toward developing the total individual; i.e. an individual able to perform all of his life roles with the skill, knowledge, and understanding necessary for success in all of these roles. It aims at developing the self-motivating and self-fulfilled individual who is a constructive force in the maintenance and improvement of the social body of which he is a part.

To meet the needs of individuals of all educational levels and ages, five phases of career education need to be implemented: awareness, orientation, exploration, preparation, and adult and continuing education.

Career awareness, emphasized early in the career development program, is to lead the individual in developing certain fundamental attitudes toward himself, toward other people, and toward work. Career orientation and exploration--emphasized in the middle school years--provides appropriate educational experiences which enable the individual to become familiar with the economic system and which allow the individual to explore various occupational clusters, to obtain initial work experience, and to integrate work values into his personal value system. The career exploration phase places equal emphasis on exploration of specific occupational clusters and on the relevancy of academic subject matter to career goals. During the preparation

phase, which may begin at grade ten or later, the individual narrows his choices of careers and prepares to enter the labor market or to continue his education. The purposes of adult and continuing education are to assist in the individual's advancement and to aid adults in discovering, analyzing, and preparing for new careers.

Accepting the philosophy underlying career education probably means change for the educator and the educational system; it certainly means additional planning and organizing. Adopting this new concept could mean adding totally new programs, changing present programs, training new personnel, and/or developing new courses of study.

To say that education must change is one thing; implementing that change is something else. This guide, "Exploring Careers in Transportation," is one of eleven such guides (including"Orientation to the World of Work," an introduction to all the guides) which can be used as a resource for teachers in implementing the exploration phase of career education in the middle/junior high school.

The following are suggestions for implementing this guide:

(1) It can be used as one of the eleven guides as resource materials for a series of mini-courses or activity courses, each dealing with a separate occupational area of cluster.

(2) It can be used as a resource to integrate career exploration activities into the existing curriculum.

In either option, this career exploration cluster guide can provide a valuable resource for student exploration of the transportation cluster.

INTRODUCTION

Purpose of the Guide

"Exploring Careers in Transportation" is designed to assist the teacher in exploring with seventh, eighth, and ninth grade students the many occupational opportunities within the transportation cluster. It is hoped that the information in this guide will help the students become more aware of the types of existing jobs which they feel might be enjoyable, satisfying, and profitable. It is also hoped that they will be able to couple this knowledge with an awareness of their own skills, abilities, and limitations and begin to analyze some specific careers which might be suitable for them. They should also be able to develop some long-range viewing habits as to the endurance and stability of that career. This is by no means intended to imply that the student should finalize the selection of a career at this early age; however, it is intended that he should develop a catalogue of careers which might be used when the time for making a selection does come.

Therefore, the guide is designed to take a broad look at all jobs in the transportation cluster including those within the peripheral range which are only remotely connected. It also takes a very close look at a few specific jobs. The intentions of each unit are outlined in the unit purpose and performance objectives.

This guide should: (1) give a broad listing of occupational opportunities, (2) convey information needed for a thorough understanding of the work area, (3) help develop the ability to view incisively economic trends, and (4) describe specific jobs in order to provide a complete understanding of the characteristics of these transportation careers.

Suggestions for Using the Guide

The transportation cluster is very complex because there are many interrelated areas. There has been an attempt to establish a comprehensive uniform outline for all areas throughout the guide in the hope that the teacher will be able to easily select whichever bank of information will be helpful to the instruction of the course. The time permitted for teaching the course will determine how extensively the guide will be used. If, because of the time factor, there is a necessity to delete certain portions of this instructional instrument, it is suggested that parts of the historical development be omitted since this is related information and not as important to making students aware of job opportunities as other areas of information. Of course, it will be left to each instructor to take from the guide such information as will be beneficial to the teaching of the course.

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UNIT ONE

INTRODUCTION TO THE EXPLORATION

OF

OCCUPATIONS IN TRANSPORTATION

UNIT PURPOSE: To provide a historical and occupational background study before focusing on the transportation cluster

PERFORMANCE OBJECTIVES: The student will be able to

I. Analyze the importance of transportation to modern society.

II. Identify the four major job family areas of transportation in our modern society.

III. Analyze the connection between transportation and other related areas.

I. The student will be able to analyze the importance of transportation to modern society.

A. Suggested Content

1. Definition of Transportation

a. The English language use of the word is a derivation of the Latin word trānsportāre.

(1) Trāns - meaning from one place to another
(2) Portāre - meaning to carry

b. Transportation is the movement via man's system of conveyance of the following:

(1) People
(2) Materials, animals, goods and products

2. The Four Types of Transportation

a. Land transportation
b. Water transportation
c. Air and space transportation
d. Conveyance systems

3. The Evolution of Transportation

a. Early man was nomadic.

(1) Local environment for sustenance exhausted rapidly.
(2) Mass movement was essential for survival.

--Movement of masses and possessions was dangerous and difficult.
--There is little evidence that organized movement was related to trade activities.

b. Early man discovered that sleds and primitive carts increased his mobility.

(1) Domestication of animals gave man a source of power.
(2) Basic transport-related inventions aided man.

--Containers, vessels, baskets and other carrying devices expedited transportation.
--Invention of the wheel marked a significant advancement.

c. Movement depended on availability of possible routes.

(1) Dwellings and settlements were established at points along routes that required changes in direction, means of movement or material being moved.

(2) Trade routes become established as man traded surplus goods.

d. Man's social organization was largely determined by his residence environment and his mobility.

(1) Man settled near the water and found that water transportation was efficient and profitable.
(2) Successful agriculture depended on man's having access to shipping routes and facilities.

e. Man was largely limited to land and water transportation until flight was perfected and air systems became organized.

(1) Movement on land has become increasingly sophisticated.

--Travel has evolved from the horse-drawn carriage to automated, remote-control transit systems.
--Movement of goods has advanced from push cart to modern, high-speed trucking.

(2) Modern water transportation involves enormous tankers and hydrofoil vessels.
(3) The potential of transportation via aircraft and space vessels seems to be unlimited.
(4) Pipelines and other conveyance devices are used by most modern businesses and industries.

4. The Effects of Transportation Upon the World Community

a. Exchange of raw materials

(1) Petroleum
(2) Coal
(3) Ores

b. Exchange of foodstuffs

(1) Coffee
(2) Grains
(3) Sugar
(4) Vegetables

c. Exchange of finished products

(1) Automobiles
(2) Radios
(3) Jewelry

d. Exchange of cultures

(1) Languages
(2) Ideas
(3) Services

5. The Effects of Transportation Upon the United States

a. Transportation as it relates to historical development

(1) Transportation was important in the discovery of America.

--New trade routes were being sought.

(2) Waterways provided a means of exploration and discovery within the continent.
(3) Wagons provided a means for early expansion.
(4) Railroad trains provided a means for rapid expansion and settlement of the west.
(5) Automobile assembly line manufacture provided the basis for world economic domination.
(6) Air and space discoveries have helped America maintain scientific and economic prominence.

b. Transportation as it relates to regulatory agencies

(1) Many United States federal agencies are involved in activities related to transportation. The following list identifies some agencies and their responsibilities:

--Department of Transportation - coordinates research and regulatory efforts of national transportation systems
--Department of Commerce - promotes projects to improve ports and facilities
--Bureau of International Commerce - provides informational services regarding world trade
--U.S. Travel Service - provides public information on travel; encourages travel in the U.S. by residents of foreign countries
--Director of Civil Works, U.S. Army Corps of Engineers - improves navigation facilities, undertakes flood control, combats erosion and provides for development of recreational facilities
--Urban Transportation Administration - provides for development and improvement of transportation systems in urban areas
--Federal Aviation Administration - coordinates, investigates, approves aircraft and aircraft facilities
--United States Coast Guard - enforces vessel inspection laws; protects humans, fish and wildlife from water pollution and contamination; and supports recreational boating

(2) Several agencies depend on transportation as a major operating function.

--United States Postal Service
--United States Armed Services
--Amtrack System
--National Aeronautics and Space Administration
--Panama Canal Company

(3) Local governments control and regulate traffic.

c. Transportation as it relates to business and industry

(1) Moves raw materials to factories
(2) Delivers finished products where needed
(3) Contributed to the shift from an agricultural to an industrial society
(4) Contributed to economic growth and the rise in the standard of living

d. Transportation as it relates to private individuals

(1) Determines where a person lives, works and spends vacation and leisure time

B. Suggested Teaching - Learning Activities

1. Have each student identify orally three visible items that have been affected by some means of transportation. (NOTE: Everything the student sees has at some time encountered a form of transportation.) Show transparency master "Before Man--What?" p. 34. Students should discuss the topic "Life Without Modern Transportation Means."

2. Form several teams and devise means of transporting various tiems around the classroom. Impose whatever restrictions are necessary for the promotion of creative thoughts.

3. Assign a class committee to construct a three-dimensional time-line chart depicting the transition of early man's methods of movement through a series of inventions leading to modern times. Show transparency master "Population Mobility," p. 35 and "All Transportation," p. 36.

4. Have students bring in, for viewing and discussion, models of boats, ships, wagons, cars, planes, etc.

5. Prepare a chart showing the various burden-bearing animals that man has domesticated.

6. Prepare maps depicting trade routes during man's civilization advances.

7. Visit a museum where the history of transportation has been incorporated.

8. Have the student bring in or identify one American-made product that required raw foreign materials. Identify transportation involved from raw material state to his possession, e.g., rubber ball.

9. Have the student name foods which are consumed daily and originate in foreign countries. How do they arrive?

10. Discuss with the students an American custom which originated in a foreign country. How was this custom exchanged?

11. Invite a representative from a governmental agency to inform the class about his department's responsibilities to transportation activities.

12. Identify ways in which traffic controls are administered within the school system. (Movement of students - buses, patrol boys; movement of materials - books and supplies)

C. Suggested Evaluation

1. The student will list and discuss in writing the importance of transportation in the discovery and development, geographically and economically, of the United States of America. Evaluate on the basis of the number of transportation influences cited.

2. Working in pairs, students will plan vacations for each other, and list all of the means of transportation encountered from start to finish. Evaluate according to the originality of the transportation itinerary.

D. Suggested Resources

1. Books

a. The American Heritage Dictionary of the English Language

b. Revolution in Transportation

2. Booklets

a. "Transportation Progress"

b. "United States Department of Transportation Facts and Functions"

3. Films

a. "Development of Transportation"

b. "Transportation in the Modern World"

4. Resource Person

   a. Local transit employee

5. Transparency Masters

   a. "Before Man--What?" p. 34

   b. "Population Mobility," p. 35

   c. "All Transportation," p. 36

II. The student will be able to identify the four major job family areas of transportation in our modern society.

A. Suggested Content

1. Land transportation generally includes two subsystems representing thousands of careers and hundreds of occupational groupings categorized with dozens of job families.

a. Highway Transportation

(1) Highway vehicle manufacture and distribution
(2) Mass transportation
(3) Private vehicle uses
(4) Taxi service
(5) Trucking
(6) Traffic management
(7) Highway systems (Tollways)
(8) Military systems
(9) Farm transportation
(10) Recreational

b. Rail Transportation

(1) Freight transport
(2) Mass transportation
(3) Manufacturing and construction
(4) Maintenance and repair systems
(5) Bridges and right-of-way systems

2. Water transportation includes several subsystems and is the most economical of all the transportation systems. For moving goods, more tonnage can be hauled by a simple carrier, and for moving people, more passengers can be moved at less cost.

a. Ocean transport
b. Inland lake transport
c. River and seaway transport
d. Canal systems
e. Military
f. Recreation
g. Shipbuilding

3. Air and space (airborne) transportation promises to advance rapidly and involve much career and employment activity because of the continuous demand for rapid movement of people and goods at a reduced cost due to technology. The airborne transport systems represent several subsystems:

a. Air craft building
b. Air passenger services

c. Space travel
d. Military
e. Recreational

4. Conveyances

a. Pipeline systems: the largest subsystems within conveyances

(1) Transporting liquids

--petroleum products
--chemicals
--water systems

(2) Transporting solids

--coal and minerals

(3) Transporting gases

b. Intermodal systems

(1) Raw materials
(2) Assembly lines
(3) Warehousing

c. Systems for moving people

(1) Elevators
(2) Escalators
(3) Mobile ramps and sidewalks
(4) Cable systems
(5) Recreational

B. Suggested Teaching-Learning Activity

1. Involve the students in a discussion of processes which are related to the four systems of transportation.

Situation: There is an airplane in flight somewhere over Kentucky. Trace the journey of its fuel from an oil field in Iran to the present location in the airplane fuel tank, and cite the methods of transportation required to be in this position. This will involve all four major areas of transportation. See "Identify the Four Occupational Areas of Transportation," p. 37.

2. Have the students prepare displays of sample materials that are transported by means of each of the four systems.

3. Choose a system and plan a class visit to a local business or industry representing that transportation system.

C. Suggested Evaluation

1. Have each student list and discuss why the four categorical transportation systems are important to him. Evaluate the paper on the basis of understanding of the four major job family areas.

2. Have the students outline man's major stages of advancement in transportation.

3. Have the students list five inventions related to transportation. Evaluate on the basis of importance of the invention.

D. Suggested Resources

1. Books

   a. The American Heritage Dictionary of the English Language

   b. International Encyclopedia of the Social Sciences/Vol. 16

   c. Revolution in Transportation

2. Booklets

   a. "Transportation, Background and Issues"

   b. "Transportation Progress"

   c. "United States Department of Transportation--Facts and Functions"

   d. "Yellow Pages of Learning Resources"

3. Films

   a. "Development of Transportation"

   b. "Transportation in the Modern World"

4. Guide

   a. "Transportation"

5. Magazine

   a. Kaiser News, "Mobility: From Here to There"

6. Transparency Master

   a. "Identify the Four Occupational Areas of Transportation," p. 37

III. The student will be able to analyze the connection between transportation and other related areas.

A. Suggested Content

1. Transportation as it Relates to Manufacturing

a. The largest manufacturing industry in the world is based on transportation requirements.

(1) Vehicle manufacturing

--Passenger car sales in 1930 totaled 2,785,000.
--Passenger car sales in 1970 totaled 9,000,000.

(2) In 1967 truck ownership in the U.S. totaled 15.36 million.

(3) In 1967 automobile ownership in the U.S. totaled 97 million.

--26% of U.S. families own two or more cars.

(4) Millions of jobs in manufacturing exist to support transportation.

--Parts and components for highway vehicles
--Instruments and devices for traffic control
--Motorcycle manufacturing
--Aircraft manufacturing
--Watercraft manufacturing
--Conveyance system manufacturing
--Spacecraft manufacturing
--Safety systems manufacturing
--Railway units manufacturing
--Communication systems manufacturing
--Pipeline equipment manufacturing
--Intermodal and warehousing systems
--Manufacturing of equipment for support services to transportation systems

b. Transportation plays an essential role in manufacturing by moving raw materials, finished products, components, tools, equipment and workers to and from appropriate locations and distribution points.

(1) Examples of raw materials used in manufacturing

--Iron ore
--Bauxite
--Silica
--Magnesium
--Latex
--Petroleum
--Coal
--Clay

(2) Examples of processed materials used in manufacturing

--Iron and steel
--Aluminum
--Glass
--Rubber
--Fibers
--Lubricants
--Plastics
--Wire
--Paint

(3) Examples of manufactured items and components necessary in transportation

--Engines
--Wheels
--Hulls
--Spokes
--Canopies
--Cables
--Meters
--Windshields
--Gauges
--Filters
--Lights
--Rails
--Propellers
--Shafts
--Axes
--Bearings
--Housings
--Frames

2. Transportation as it Relates to Construction

a. The construction industry provides the transportation industry with all operational facilities except those classified within manufacturing.

(1) Building construction

--Offices
--Terminals
--Stations
--Hangers
--Depots
--Garages
--Control centers
--Blockhouses
--Silos
--Towers
--Shipyards

(2) Route facilities construction

--Highways
--Guard rails
--Interchanges
--Dividers
--Tunnels
--Bridges
--Canals
--Channels
--Locks
--Dams
--Sidewalks
--Runways
--Ramps
--Pipelines
--Drainage systems
--Subways

(3) Construction activities related to services and support

--Engineering
--Surveying and topographical investigation
--Landscaping
--Earthmoving
--Dredging
--Right-of-way procurement

b. The transportation industry provides the most vital services to the construction industry through the movement of materials, equipment and workers.

(1) Materials

--Lumber
--Concrete
--Steel
--Pipe
--Sand & gravel
--Forms

(2) Equipment

--Trucks
--Bulldozers
--Cranes
--Tractors
--Dredgers
--Barges
--Shovels
--Drills
--Conveyors
--Loaders
--Welders

3. Transportation as it Relates to City Planning

a. Man's social patterns and economic requirements create a demand for mobility.

(1) Life in urban and suburban areas requires that individuals commute.

--Travel to school, to work, to market and to carry out other social activities is necessary.

(2) Availability of land in populated regions is becoming critical.

--In 1930, about 30 acres of land were used to accommodate each additional 1000 new urban dwellers. Current usage has risen to about 200 acres.

(3) Minority and disadvantaged peoples do not have access to adequate transportation services.

(4) The private automobile has become the standard of transportation in the United States and many other countries.

--Automobile registration rises annually while public transit use declines.

--Automobile manufacturing and related activities contribute more than 10 percent of the gross national product.

b. In many cases, the automobile has dictated the growth pattern and physical appearances of our cities.

(1) In 1968, 9.6 million passenger cars were sold in the U.S.

(2) Each mile of four-lane freeway consumes over 117 acres of land.

(3) Seven million cars are junked annually.

--Recycling of materials is an insignificant activity in the U.S.

--Discarded automobiles continue to degrade the attractiveness of our landscape along roads, in streams and in junk yards.

--Cars are designed to become obsolete, built to wear out quickly, advertised to be out of fashion, and lack necessary safety features.

(4) When the railroad train was first developed, towns were built around railroad stops.

(5) Presently, growth and development is sometimes determined by freeways.

c. As an alternative to the automobile, new transit systems are needed to serve the masses of people.

(1) The fuel shortage is demanding that new mass systems be developed.
(2) Some suggested systems:

--Rail systems
--Busing systems
--Public taxicab systems
--Bicycle routes
--Walking systems (This would imply "pedestrian only" areas)
--Jitney transit systems
--Car "pools"
--Moving sidewalks and conveyors
--Cable cars
--Urban helicopter

(3) Inexpensive fares would tend to reduce the use of private vehicles.

d. Old transit systems need to be revitalized.

(1) New regulations and tax reductions would encourage private enterprise.
(2) Public funds would be necessary.

e. Subways have proven to provide a fast, efficient, medium-distance method of travel that cannot be matched by any surface transportation system.

(1) Modern subway systems are being developed in many metropolitan areas.
(2) Advantages of subways

--Electric powered
--No traffic congestion
--Uninterrupted schedules
--Fast station to station service
--Greatly reduced noise compared with surface trains
--Proven safety record
--Economical operation allows cheaper fares

f. Monorail systems have proven to provide efficient, fast commuter service. Several engineering approaches have been utilized.

(1) Rail mounted
(2) Rubber wheel mounted
(3) Overhead suspension
(4) Air cushion supported
(5) Electric powered
(6) Turbine powered

g. Commuter trains have proven to be more economical and satisfactory to passengers for urban and medium distance travel than airlines and buses.

(1) Several systems are being utilized in heavily populated areas.

(2) San Francisco uses BART (Bay Area Rapid Transit).

--Uses both surface and sub-surface routes
--Electric powered
--Departure and arrival service every 1 1/2 to 2 minutes
--Averages 50 to 80 mph

(3) An eastern seaboard corridor commuter system is being planned from Boston to Washington, D.C.

--Speeds up to 160 mph
--Gas turbine powered
--Modern, air conditioned aluminum cars suspended from steel supports
--Portions of the system now in operation

(4) A new concept in the GVT (Gravity Vacuum Transit) will move cars through deep tunnels via atmospheric pressure at speeds in excess of 500 mph.

h. In our early history, cities developed along waterways.

i. Airports are located so as to prevent noise pollution and other flight hazards.

4. Transportation as it Relates to Environmental Controls

a. New areas of employment are developing because of major types of environmental interferences related to transportation.

b. Causes and characteristics of air pollution

(1) Oxygen imbalance caused by:

--Burning of hydrocarbon fuels mixed with large proportions of air
--Heavy introductions of fuel exhausts containing carbon monoxide and hydrocarbons, hydrogen sulfide and carbon dioxide
--Destruction and defoliation of oxygen-producing plant growth--much destruction occurs due to the following types of activities:

-Highway construction
-Building construction
-Canal construction
-Harbor construction

-Airport and runway construction
-Pipeline construction
-Insect control
-Bridge construction
-Parking lot construction
-Railway construction

c. Causes and characteristics of atmospheric thermal pollution

(1) Introduction of excess heat into the atmosphere from manufacturing activities
(2) Burning of fuels for power sources
(3) Operation of air conditioning systems
(4) Construction of heavy concentration of buildings and vast expanses of paved areas such as highways, airports, parking lots; results in abnormal cycles of heat absorption and reflection which creates large areas of heat concentration
(5) Destruction and defoliation of plant life which refreshes air by producing oxygen and shade for land surfaces

d. Causes and characteristics of water pollution

(1) Industrial discharge of heated water and wastes, marine engine cooling and exhaust, containment of water in dams and locks and runoff from paved surfaces
(2) Water purity frequently degraded by fuel spills and leakage, sewage discharge from ships and cities, runoff from mining and agricultural operations and by the dumping and discard of trash and litter

e. Types of noise pollution

(1) Manufacturing noise in industrialized areas
(2) Engine and exhaust noises in traffic areas
(3) Aircraft noises in airport locales

f. Deterioriation of natural resources

(1) Heavy production of vehicles requires vast amounts of minerals, metals, fibers, chemicals and fossil fuels.
(2) Highway, airport and paved area construction denudes hundreds of thousands of acres of forest areas.
(3) Damming of rivers and streams inundates hundreds of thousands of acres of wildlife habitat.
(4) Surface and strip-mining practices destroy and pollute.
(5) Oil, fuel and chemical spillage and dumping destroys water life and habitats.
(6) Heat and noise pollution forces migration of wildlife.
(7) Swamp drainage destroys natural habitats of wildlife.

(8) Fertilizer runoff causes unnatural nutrient supply for water plants causing overgrowth and subsequent clogging and oxygen starvation of streams and lakes.

g. Solutions to the environmental disturbances

(1) Reasonable governmental controls, restrictions and standards on the regulation of vehicle exhausts, industrial discharges and disposal of wastes
(2) Reforestation practices to be required of all individuals, corporations, and governments involved in any deforestation activity
(3) Strict anti-water pollution regulations
(4) Development and application of new energy sources, such as geothermal energy, solar energy and atomic energy
(5) Development of more efficient power units, such as external combustion engines, electrical applications
(6) Establishment of regulations limiting noise levels in non-industrial areas
(7) Protection of natural areas for the preservation of plant and animal species
(8) Continuous search for useful technology for application in the extension of necessary resources such as mining, drilling, and harvesting

5. Transportation as it Relates to Communication

a. Communication is defined as transmitting and exchanging information.

(1) Various methods of communicating are used in transmitting information.

--Verbal
--Nonverbal
--Visual
--Auditory

(2) Modern technology, especially in electronics, has resulted in highly sophisticated communications systems.

--Telephone and telegraph
--Radio and television
--Satellite communication systems
--Laser communications
--Printing and publishing
--Computer information systems
--Signal systems

(3) Transportation depends on communication systems in order to function.

--Information systems

-Roadmaps
-Navigation charts
-Direction and control signs
-Weather information systems
-Military reconnaissance

--Monitor and control systems

-Signal devices
-Automatic pilot systems
-Traffic control and flow systems
-Switching systems
-Timing systems
-Material flow systems
-Pipeline contents and flow
-Warehousing functions
-Storage and retrieval systems
-Production and manufacturing

--Equipment maintenance and repair notification systems
--Civil defense and emergency warning systems
--Security systems
--Military systems

6. Transportation as it Relates to Power and Energy

a. Transportation systems would not be possible without relatively inexpensive power sources.

(1) Domestication of the horse provided man with a reliable source of power with which to do work.

--James Watt devised a formula for measuring work efficiency using draft horses.
--Origin of the measure of horsepower

(2) Man discovered that by burning fuel, he could convert energy to force in order to do work.

--Two kinds of energy must be considered.

-Potential energy - stored (not active) energy
-Kinetic energy - energy in motion

(3) Work is defined as the amount of force multiplied by distance.

b. There are several common methods of converting heat energy to mechanical energy.

(1) External combustion

--The external combustion engine is a mechanical energy device that receives its heat energy from fuel having been burned outside the engine cylinder.
--The steam engine is the most common application of converting external combustion heat energy to mechanical energy.
--Many fuels have been used to produce steam power, such as wood, oil, gas and kerosene. However, coal is most abundantly used.
--Once the major source of mechanical power in the 20th century, the steam engine has virtually been replaced.

(2) External combustion engines

--Steam-powered engines are used in experimental automobiles, farm vehicles and locomotives.
--Water is most commonly used in generating boilers; however, in recent years some low-temperature evaporants have been successfully used.

(3) Two types of steam engines

--Reciprocating (piston-type)
--Steam turbine

(4) The steam engine was used to power some production automobiles in the early 1900's.

--Stanley, White, Locomobile

(5) Internal combustion

--The internal combustion engine is a device that converts potential energy (the heat energy contained in fuel) into kinetic energy (useful mechanical energy).
--All combustible materials contain heat energy, but only a few are suitable as fuel for internal combustion engines.

-Gasoline, liquid petroleum gas, natural gas, methane are suitable.
-Gunpowder, dynamite are unsuitable.
-Kerosene and other grades and types of fuel oil are suitable for Diesel and turbine applications.

--The most common internal combustion engine for automotive application is the four-stroke cycle piston engine. Gasoline is the most commonly used fuel.

--As the contained fuel burns, it expands, releases heat and exerts the force to initiate the kinetic energy.
--Explosive force in the cylinder pushes the piston creating the initial movement in the mechanical energy train.
--The necessity of controlling the energy and motion has led to the modern, complicated automotive engine systems.
--Reciprocal type internal combustion engines are mostly commonly used, but rotary engines are becoming popular.
--Turbine engines have been experimentally used and have been adapted for special uses.

(6) Much electrical energy is utilized in transportation systems.

--Electricity is produced in useful quantities through the following physical actions:

-Mechanical-using magnetism in reciprocal and rotating machines to generate electricity; sources of mechanical power are wind, water, internal combustion, steam, hand power.
-Chemical - batteries to produce and store power are energized chemically.
-Light-photoelectrical cells, using semiconductors, convert sunlight or artificial light into electrical energy.
-Heat-thermoelectricity utilizes heat energy imposed upon dissimilar metals to produce a potential difference which creates electrical energy.
-Pressure-certain crystals, such as quartz, emit electrical energy when squeezed or strained.
-Friction-static electricity is produced by friction between two materials.

--It is anticipated that stored electrical energy will be widely utilized for transportation as other fuel supplies decrease.
--Improved storage battery technology is permitting wider application of electrically powered vehicles.
--Diesel-electric power units have been used in locomotives for several years.
--Individually powered electric wheels have been successfully used in trucks and heavy equipment type vehicles.
--There are small land vehicles using storage batteries as an energy source.

-Golf carts
-Light-weight automobiles
-Small inter-city taxis and buses

B. Suggested Teaching-Learning Activities

1. Organize the class into groups representing suppliers of raw materials, material manufacturers, parts (components) manufacturers, product manufacturers. Have them conduct an industrial fair. They can display samples of raw materials and products that relate to manufacturing and transportation, and design flow charts describing the cycles of manufacturing activities. Many occupational categories relating to these activities can be discussed. See "Demands," p. 38.

2. Have the students describe in writing the interdependence of transportation and manufacturing. See "Manufacturing" p. 39.

3. Have the students construct three-dimensional scale models of roads, tunnels, bridges, buildings, canals, dams, etc. This project could be used for display purposes after completion.

4. Discuss the many occupations that are important to both construction and transportation.

5. Have the students prepare a listing of transportation problems in your locale and plan solutions to the problems that do not depend entirely on the use of private vehicles.

6. Invite a local government representative to speak to the class about mass transportation problems.

7. Select sections from a city map and calculate the ratio of land area consumed by roads, interchanges, highways, streets and parking lots.

8. Design a system for moving people between urban and suburban sections of a metropolitan area. Several modes of transportation could be considered. City maps are readily available by writing to chambers of commerce and civic organizations and from banks, motels and real estate agencies.

9. Have the students prepare a listing of occupations required for planning and operating mass transportation systems. They should also relate the occupations to job responsibilities and training requirements.

10. Have the class write letters of inquiry to local, state and federal agencies regarding environmental protection activities and regulations. An appropriate follow-up might be the identification of a local environmental problem that the class could accept as a solution challenge by creating public and governmental agency awareness. Attention should be directed to the problem until a satisfactory solution is achieved.

11. Prepare a local, state or world map identifying areas of reserve abundant natural resources and compare with the availability of these resources of 50 years past, of 100 years past, and more.

12. Prepare a bulletin board display that projects world national and state population growth and charts anticipated depletion of natural resources. See "Kentucky Population Centers," p. 40 and "Population Growth," p. 41.

13. Invite representatives of oil, gas and/or electrical power companies to speak to the class about the impending world energy problems.

14. Prepare a cross-reference graph of several occupations in the transportation industries and several environmental concerns. This will enable students to cite and examine many career opportunities and responsibilities. See "Without Exhaust Emission Control," p. 42.

15. Build practice telegraph systems to be powered by flashlight batteries. Electromagnets can be wrapped using bell wire and iron stove bolts mounted on small wooden bases. Keys can be constructed from scrap sheet metal or tin can salvage.

16. Students should write a short paper outlining the importance of the telegraph to transportation.

17. Prepare a bulletin board display depicting some of the ways communication aids transportation. See "Communication's Growth," p. 43.

18. Build and operate a demonstration steam-turbine engine.

    a. Form a turbine wheel from a small tin can lid by making a series of uniform cuts around the perimeter and twisting (with pliers) 180 degrees to form blades. Punch a hole in the center of the lid to accommodate the wire coat hanger which will serve as the shaft. (This could also be made from Tinker Toys.)

    b. Construct a boiler from a metal container used to protect 35mm film by punching a small hole in the lid large enough to force fit a metal tube. The tube may be a portion of the metal refill from an old ball point pen.

    c. Mount the boiler and wheel on a wire coat hanger stand and use a candle to heat water within the boiler.

    d. The exit steam nozzle should be aimed off-center of the shaft and directed toward the baldes of the turbine. As the steam is produced and released, the turbine will spin. See "Steam Turbine Engine," p. 44.

19. Discuss the ways that mechanical power systems are used in transportation. See "Internal Combustion," p. 45
See "External Combustion," p. 46.

20. Prepare a list of occupational groupings resulting from the requirements of power and energy within transportation.

21. Invite a guest representing the local telephone company to discuss how communication and transportation are related.

C. Suggested Evaluation

1. The students will evaluate the transportation systems of the city in which they live as they relate to the six areas covered.

Suggested Resources

1. Books

a. Airplanes and Trucks and Trains, Fire Engines, Boats and Ships, and Building and Wrecking Machines

b. Challenge to Transportation

c. Dead End: The Automobile in Mass Transportation

d. The Death of the Automobile

e. Introduction to Transportation Planning

2. Booklets

a. "The Age of Steel"

b. "Career Opportunities with Kaiser Steel"

c. "Careers in the Oil Industry"

d. "Case Studies of Seven New Systems of Urban Transportation"

e. "Common Environmental Terms"

f. "Conserving Our Wildlife"

g. "Facts About Oil"

h. "Forestry Research--A Progress Report from International Paper"

i. "Glass in Science and Industry"

j. "Meeting the Competition for the World Tourism Dollar in the 70's"

k. "Occupations in Transportation"

l. "Paper and Paper Manufacture"

m. "Planning Rapid Transit Systems"

n. "The Picture Story of Steel"

o. "Profile for Progress"

p. "Reynolds Aluminum...and the men who put it to work"

q. "This Is Glass"

r. "Traffic Management"

s. "Train Simulator Program"

t. "Transportation"

u. "Transportation Careers"

v. "Understanding and Measuring Horsepower"

w. "Urban Public Transportation"

3. Charts

a. "Economic Growth and How It Is Measured"

b. "How Paper Came to America"

c. "Tire Manufacturing Flow Chart"

4. Films

a. "Engineering With Glass"

b. "Fair Today...Futurama Tomorrow"

c. "Metro-Mobility"

d. "The Changing Architecture of the Automobile Body"

5. Guide

a. "Environmental Action Starts Here"

6. Magazine

a. Public Roads

7. Pamphlets

   a. "A Concern for the Total Environment"

   b. "litter prevention..an aid to conservation"

8. Resource Persons

   a. City transit employee

   b. Electric, oil, or gas company representative

9. Transparency Masters

   a. "Demands," p. 38

   b. "Manufacturing," p. 39

   c. "Kentucky Population Centers," p. 40

   d. "Population Growth in 11 Largest Cities," p. 41

   e. "Without Exhaust Emission Control," p. 42

   f. "Communication's Growth," p. 43

   g. "Steam Turbine Engine," p. 44

   h. "Internal Combustion," p. 45

   i. "External Combustion," p. 46

   j. "Four Occupational Areas of Transportation," p. 37

   k. "Before Man -- What?" p. 34

   l. "Population Mobility," p. 35

   m. "All Transportation," p. 36

SUPPORTIVE MATERIALS

FOR

UNIT ONE

REFERENCE LIST FOR UNIT ONE

BOOKS

1. Airplanes and Trucks and Trains, Fire Engines, Boats and Ships, and Building and Wrecking Machines by Giorge Zaffo, Grosset and Dunlap, 1972

2. The American Heritage Dictionary of the English Language American Heritage Publishing Co., Inc., 1969

3. Challenge to Transportation Stanford University Graduate School of Business, 1961

4. Dead End: The Automobile in Mass Transportation by Ronald Buel, Prentice-Hall, Inc., 1972

5. The Death of the Automobile by John Jerome, W.W. Norton & Company, Inc., 1972

6. International Encyclopedia of the Social Sciences Volume 16, The Macmillan Company, 1968

7. Introduction to Transportation Planning by M.J. Bruton, Hutchinson Educational Ltd., 1970

8. Revolution in Transportation by Karl M. Ruppenthal, Graduate School of Business, Stanford University, 1961

BOOKLETS

1. "The Age of Steel," Inland Steel Corporation

2. "Career Opportunities with Kaiser Steel," Kaiser Steel Corporation

3. "Careers in the Oil Industry," American Petroleum Institute, 1971

4. "Case Studies of Seven New Systems of Urban Transportation," General Motors Corporation

5. "Common Environmental Terms," U.S. Environmental Protection Agency

6. "Conserving Our Wildlife," Standard Oil Company of California

7. "Facts About Oil," American Petroleum Institute

8. "Forestry Research--A Progress Report from International Paper Company," International Paper Company

9. "Glass in Science and Industry," Corning Glass Works

10. "Inventory of Federal Tourism Programs," U.S. Department of Commerce, U.S. Government Printing Office, 1970

11. "Meeting the Competition for the World Tourism Dollar in the '70s," Superintendent of Documents, U.S. Government Printing Office

12. "Occupations in Transportation," ERIC Clearinghouse on Vocational and Technical Education. The Center for Vocational and Technical Education, The Ohio State University

13. "Paper and Paper Manufacture," American Paper Institute

14. "The Picture Story of Steel," American Iron and Steel Institute

15. "Planning Rapid Transit Systems," Kaiser Engineers

16. "Profile for Progress," Eaton Corporation

17. "Reynolds Aluminum...and the men who put it to work," Reynolds Metal Company

18. "This Is Glass," Corning Glass Works

19. "Traffic Management," Cahners Publishing Company

20. "Train Simulator Program," Kaiser Engineers

21. "Transportation," White House Conference on Aging

22. "Transportation, Background and Issues," The Technical Committee on Transportation, U.S. Government Printing Office

23. "Transportation Careers," Delta Nu Alpha Transportation Fraternity, Inc.

24. "Transportation Progress," Arthur Pound, General Motors Corporation

25. "Understanding and Measuring Horsepower," American Association for Agricultural Engineering and Vocational Agriculture, Coordinator's Office, Agricultural Engineering Center

26. "Urban Public Transportation, Selected References," U.S. Department of Housing and Urban Development, U.S. Government Printing Office, 1966

27. "United States Department of Transportation-Facts and Functions," U.S. Government Printing Office, 1971

28. "Yellow Pages of Learning Resources," Group for Environmental Education, Inc. pp. 5-7, 40,41,66,67

CHARTS

1. "Economic Growth and How It Is Measured," American Petroleum Institute, 1966

2. "How Paper Came to America," American Paper Institute

3. "Tire Manufacturing Flow Chart," B.F. Goodrich

FILMS

1. "The Changing Architecture of the Automobile Body," 16mm, General Motors Corporation

2. "Development of Transportation," Encyclopedia Britannica Films, Inc., University of Kentucky Film Library

3. "Engineering With Glass," 16mm, Association Films, Inc., Corning Glass Works

4. "Fair Today...Futurama Tomorrow," 16 mm, General Motors Corporation

5. "Metro-Mobility," 16mm, General Motors Corporation

6. "Transportation in the Modern World," Coronet, University of Kentucky Film Library

GUIDES

1. "Environmental Action Starts Here," Keep America Beautiful, Inc.

2. "Transportation," Edward Ownes, Grawson County College

MAGAZINES

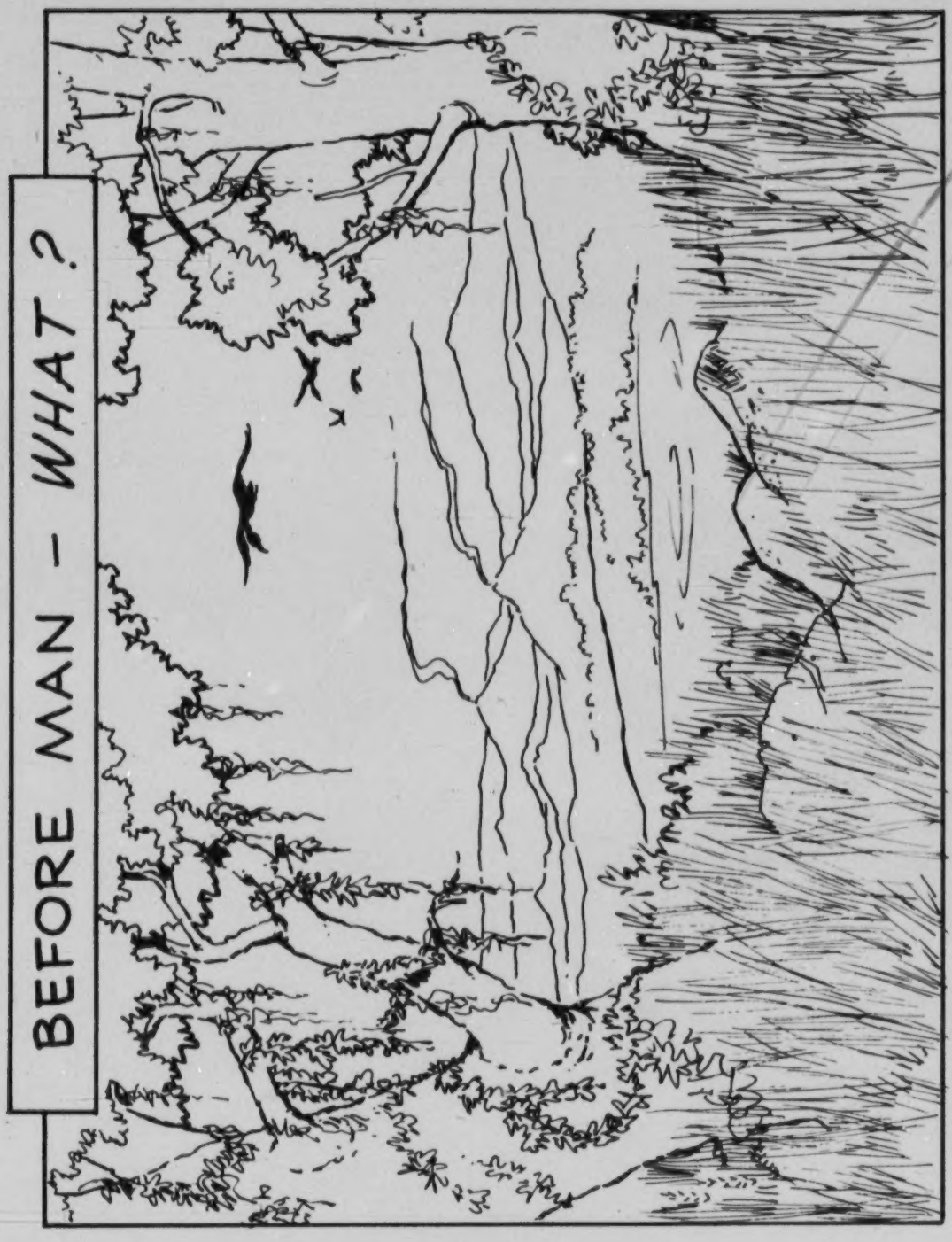
1. Kaiser News, "Mobility: From Here to There," Kaiser Aluminum and Chemical Corporation

2. Public Roads, U.S. Department of Transportation, September 1972.

PAMPHLETS

1. "A Concern for the Total Environment," Deere & Company

2. "Litter Prevention...an aid to conservation," Keep America Beautiful, Inc.



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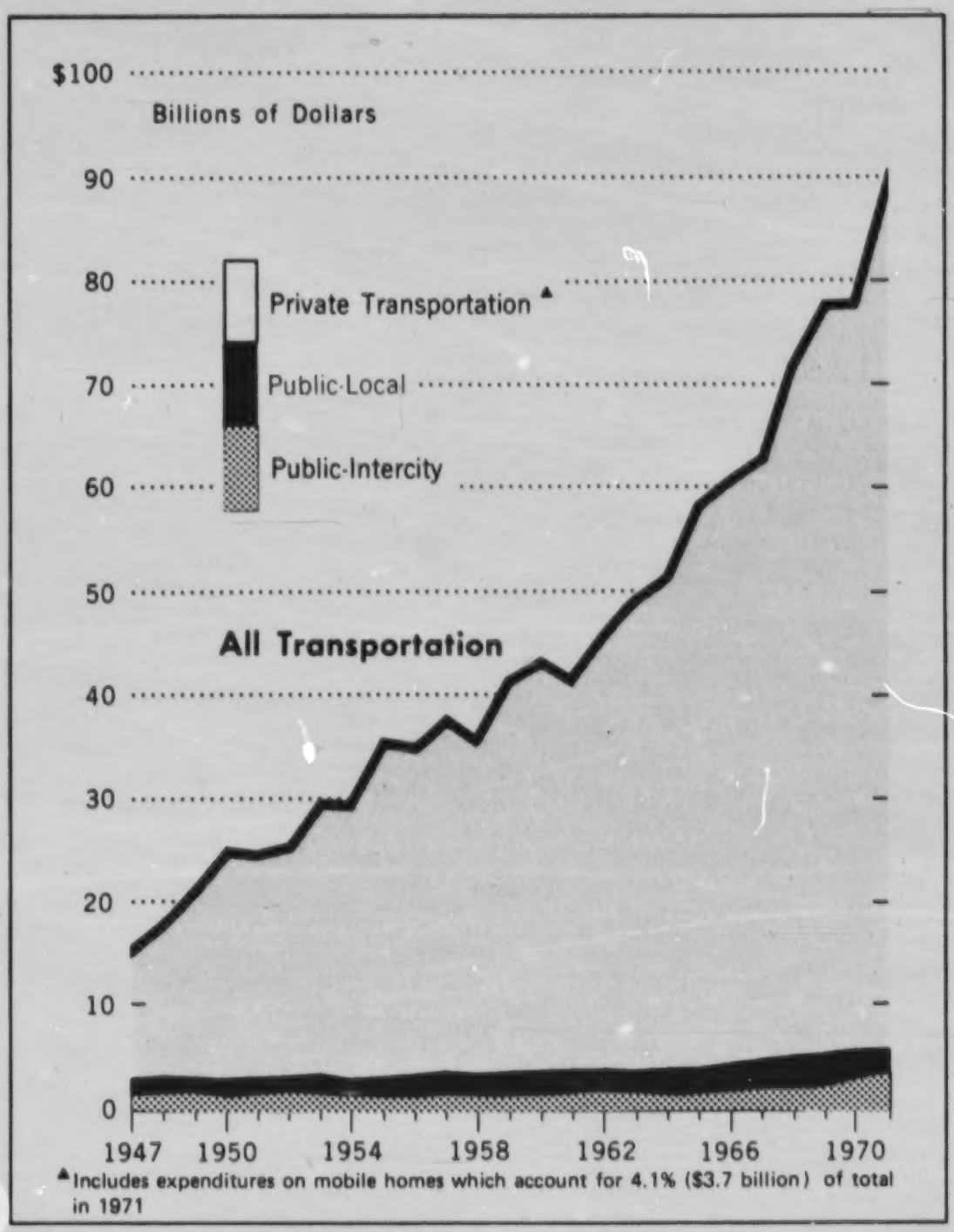
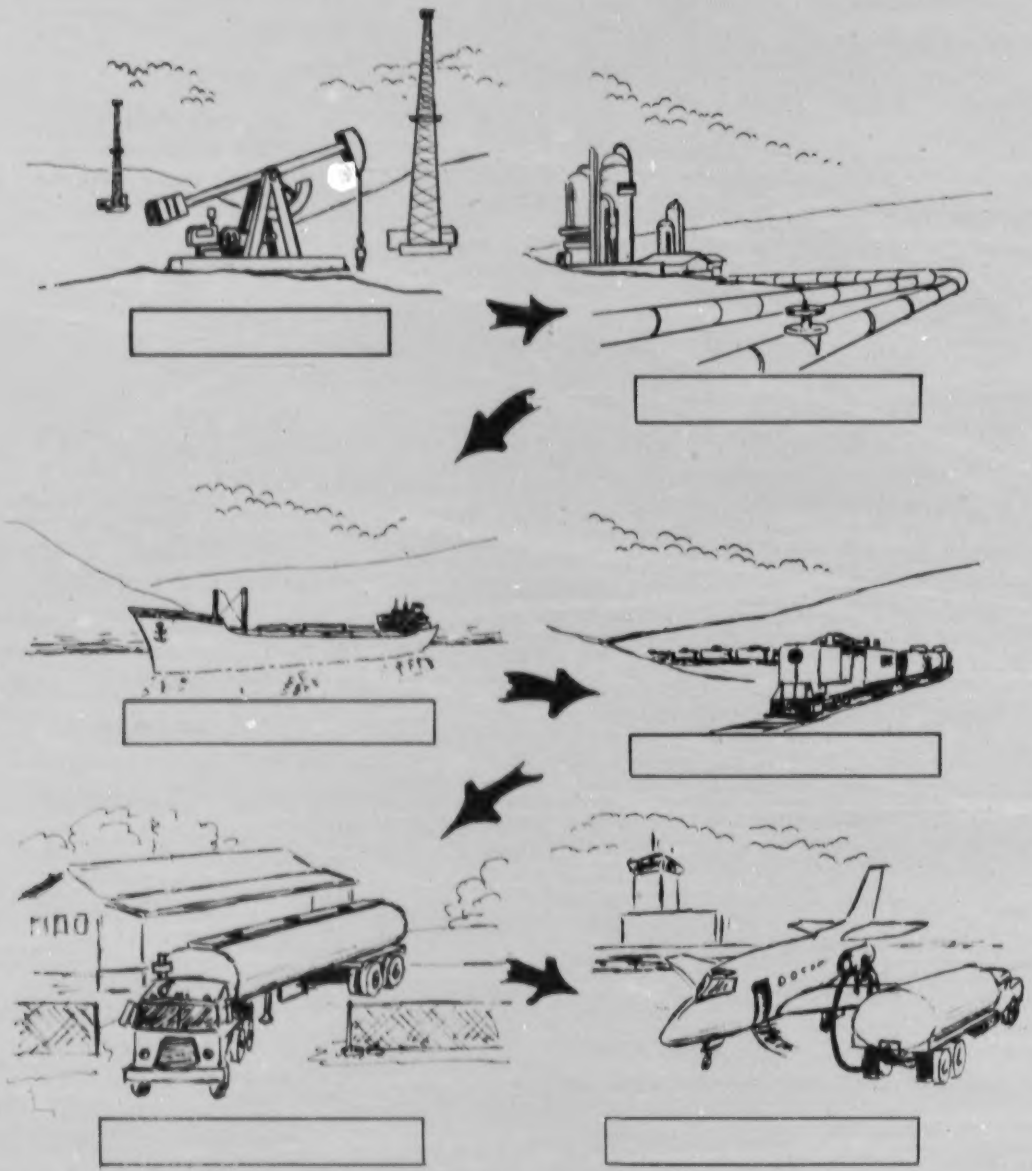
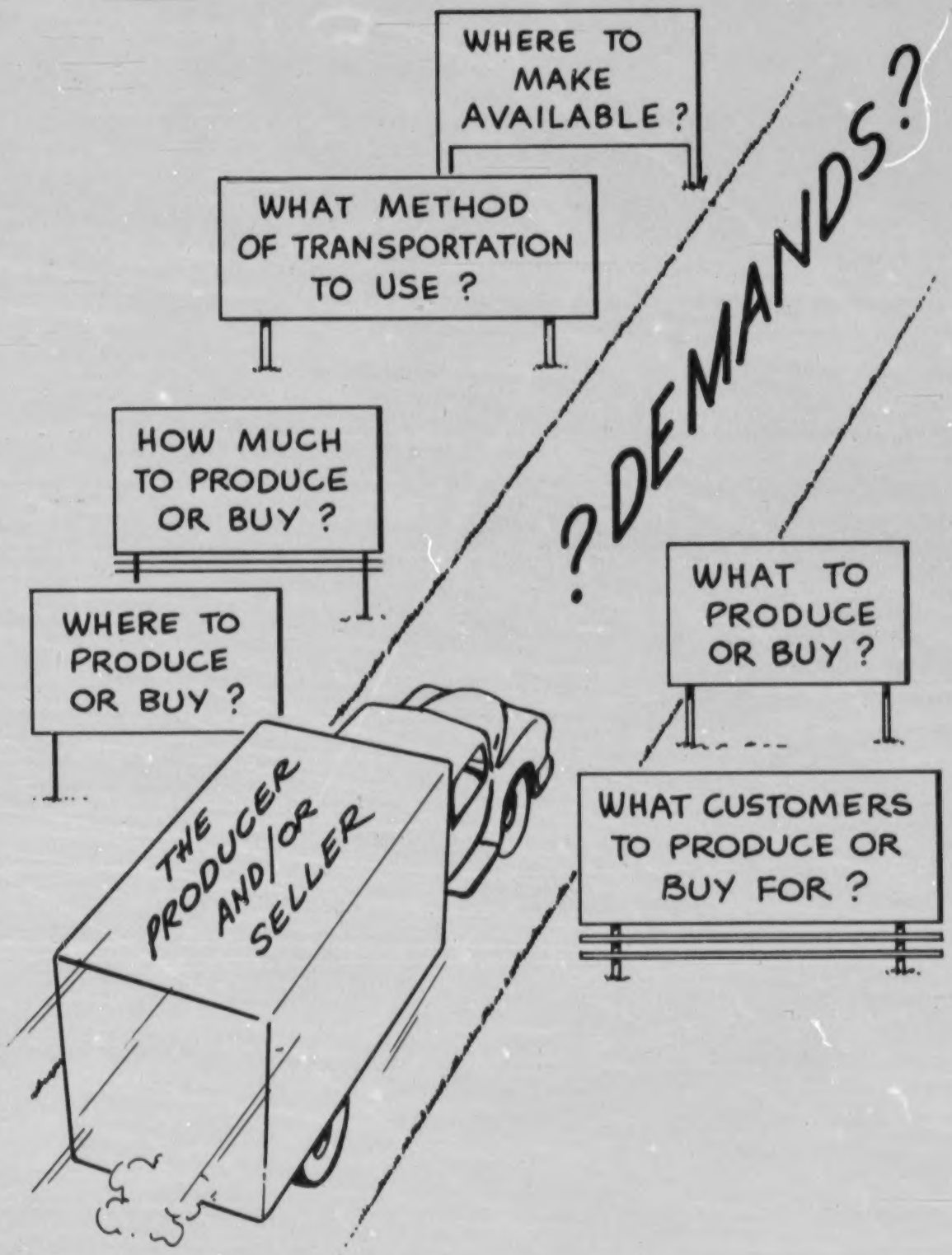


R.G. CURR. DEVE. CNTR. DR. 1019-1

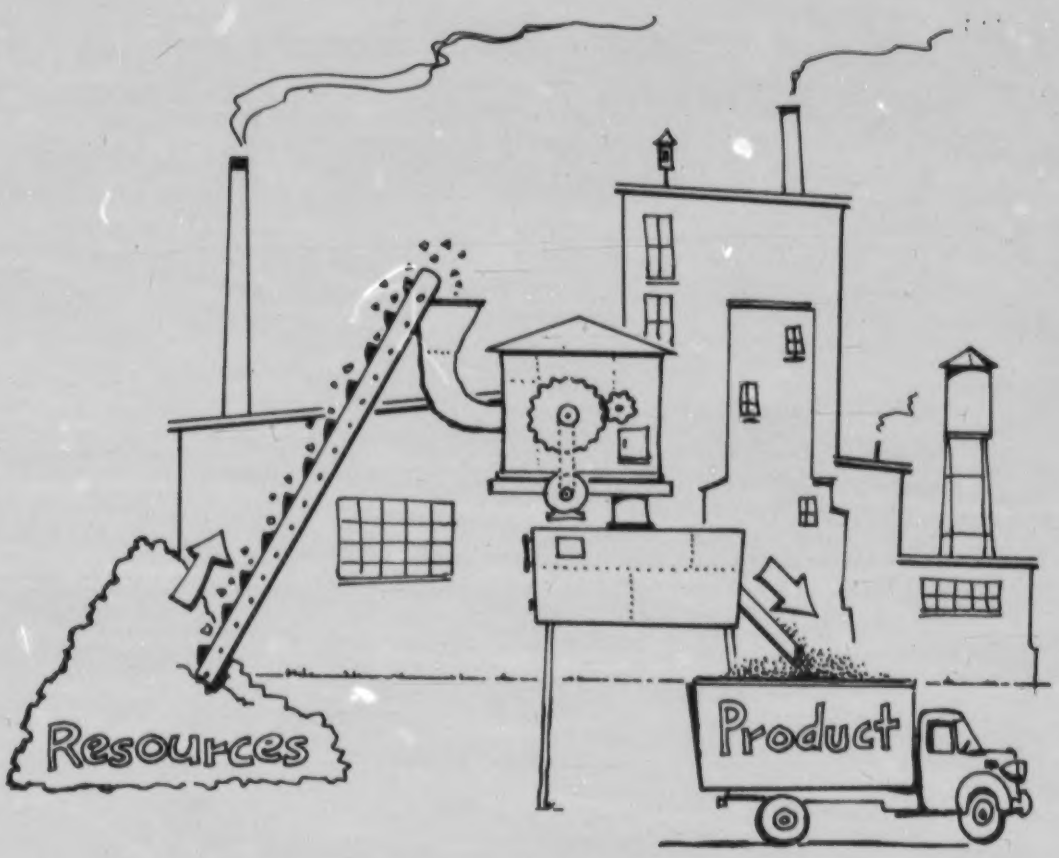
IDENTIFY THE

4 OCCUPATIONAL AREAS OF TRANSPORTATION




WHERE TO MAKE AVAILABLE ?
WHAT METHOD OF TRANSPORTATION TO USE ?
HOW MUCH TO PRODUCE OR BUY ?
WHERE TO PRODUCE OR BUY ?
?DEMANDS?
WHAT TO PRODUCE OR BUY ?
WHAT CUSTOMERS TO PRODUCE OR BUY FOR ?
THE PRODUCER AND/OR SELLER

MANUFACTURING Involves Changing, Processing, Modifying, or Organizing Nature's Resources In Such A Manner That They Are More Useful To Consumers Than They Were In Their Original Condition.



KENTUCKY POPULATION CENTERS

R. GILMORE CURR. DEVE. CNTR. UK. 999-2

Population Growth in 11 Largest Cities

City	City Population 1970	City Population 1960	% Change 1960-70	County Population 1970	County Population 1960	% Change 1960-70
Louisville	361,958	390,639	- 7.3	695,055	610,947	+13.8
Lexington	108,137	62,810	+72.2	174,323	131,906	+32.2
Covington	52,535	60,376	-13.0	129,440	120,700	+ 7.2
Owensboro	50,329	42,471	+18.5	79,486	70,588	+12.6
Bowling Green	36,253	28,338	+27.9	57,432	45,491	+26.2
Paducah	31,627	34,471	- 8.3	58,281	57,306	+ 1.7
Ashland	29,245	31,283	- 6.5	52,376	52,163	+ 0.4
Newport	25,998	30,070	-13.5	88,561	86,803	+ 2.0
Henderson	22,976	16,892	+36.0	36,031	33,519	+ 7.5
Frankfort	21,902	18,305	+19.2	34,481	29,421	+17.2
Hopkinsville	21,250	19,465	+ 9.2	56,224	56,904	- 1.2

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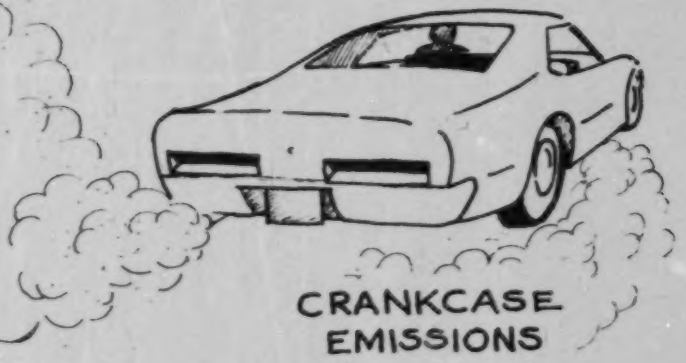
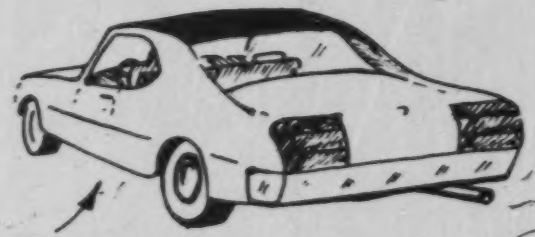
WITHOUT EXHAUST EMISSION CONTROL

NITROGEN	= 71%
OXYGEN	= 0%
HYDROGEN	= 1.2%
WATER	= 9%
CO_2	= 16%
CO	= 3.8%



CRANKCASE EMISSIONS



REDUCTION OF:
CARBON MONOXIDE TO 1.5% Max.
HYDROCARBONS TO 275 PPM.

FEDERAL LAW REQUIRES

ELIMINATION OF CRANKCASE EMISSIONS

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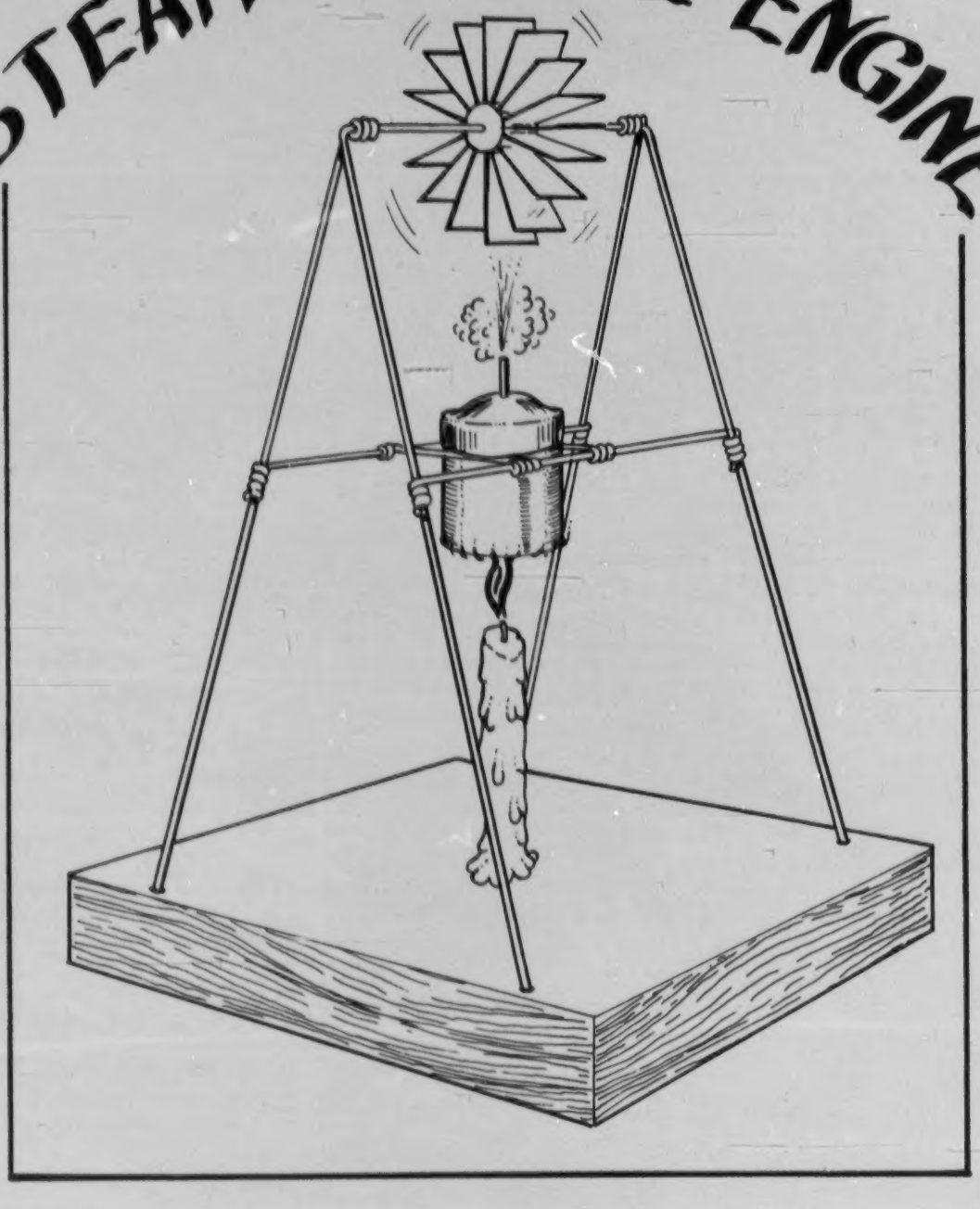
STEAM TURBINE ENGINE



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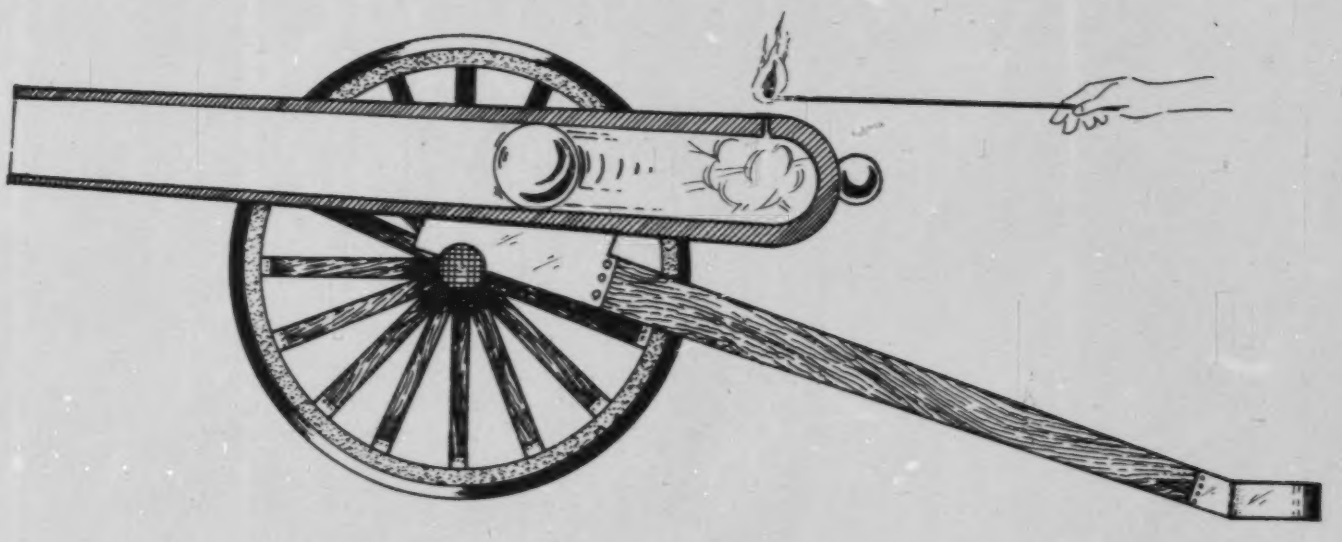
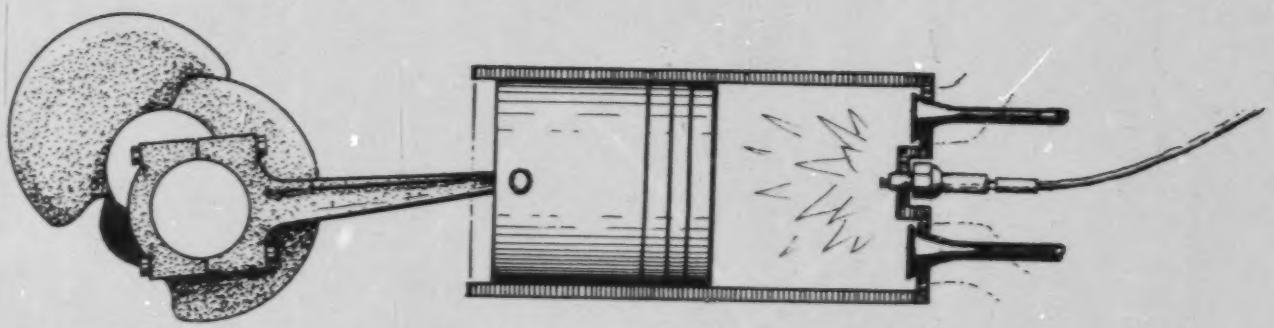
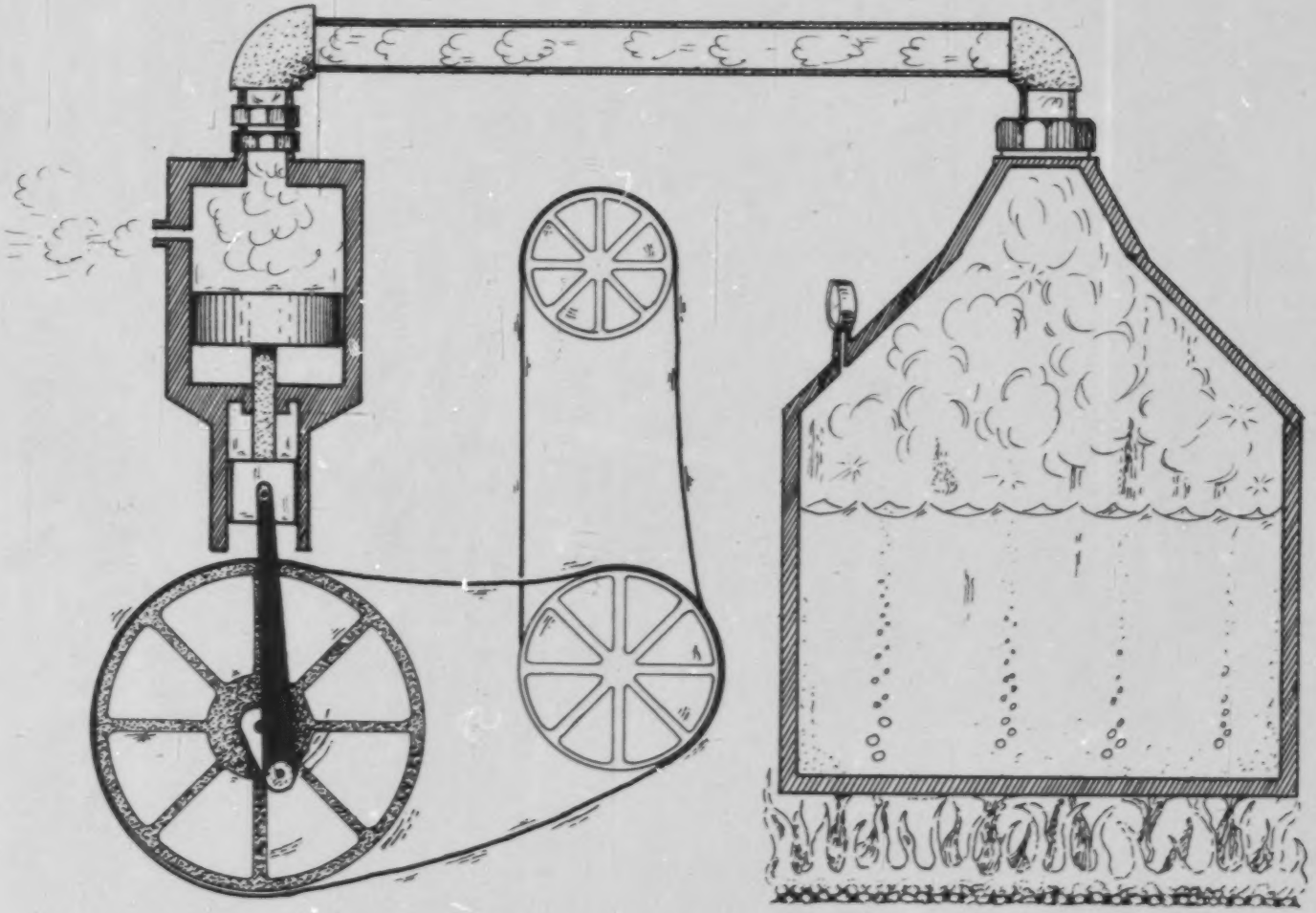
INTERNAL COMBUSTION





EXTERNAL COMBUSTION



UNIT TWO

INTRODUCTION TO THE EXPLORATION

OF

OCCUPATIONS IN LAND TRANSPORTATION

UNIT PURPOSE: To explore, in depth, background information and occupational opportunities in land transportation

PERFORMANCE OBJECTIVES: The student will be able to

I. Identify and discuss the broad range of occupational opportunities in land transportation.

II. Describe the development of land transportation and analyze its importance to the economy.

III. Examine the employment trends and necessary skills outlook in land transportation.

IV. Describe, in depth, at least two land transportation jobs.

I. The student will be able to identify and discuss the broad range of occupational opportunities in land transportation.

A. Suggested Content

1. Occupations Related to Land Transportation Power Systems

a. Corporate structure category

(1) Board Chairman
(2) Board members
(3) Stock holder
(4) Legal staff
(5) Accounting personnel

b. Planning and development categories

(1) Artists, illustrators, model builders
(2) Engineers, draftsmen, mathematicians
(3) Analysts, statisticians, researchers
(4) Secretaries, business machine operators, programmers
(5) Managers, vice presidents, production advisors
(6) Metallurgists, detailers, fabricators
(7) Physicians, therapists, personnel managers

c. Production categories

(1) Managers, secretaries, welders
(2) Machine operators, pipe fitters
(3) Electricians, machinists, custodians
(4) Drivers, supervisors, writers
(5) Repairman, millwrights, steamfitters
(6) Assembly line workers, inspectors
(7) Heat treaters, accountants, specialists
(8) Auditors, painters, dieticians

d. Service and sales categories

(1) Mechanics, machinists, installers
(2) Managers, specialists, inspectors
(3) Instructors, owners, drivers
(4) Accountants, clerks, shippers
(5) Warehousemen, salesmen

2. Occupations Relating to Mass Transportation

a. Many of the occupational opportunities for railway, commuter train, local and long distance bus systems of mass transportation are similar.

(1) Bus driver
(2) Railroad engineers
(3) Subway operators
(4) Ticket sales person

(5) Computer programmers
(6) Design engineers
(7) Traffic managers
(8) Clerks
(9) Secretaries
(10) Accountants
(11) Mechanics
(12) Electricians
(13) Architects
(14) Construction workers
(15) Operators
(16) Electronics technicians

3. Occupations Related to Freight Transportation

a. Major occupational categories in trucking

(1) Sales

--Opportunities include services and product sales.

(2) Traffic

--Employees in traffic monitor and effect rates, routes, time and conditions.

(3) Operations

--Terminal operations require dock workers, freight handlers, checkers, dispatchers, managers, service personnel and supervisors.

(4) Driving

--More than 2.5 million truck and bus drivers were employed in the U.S. in 1970.

(5) Maintenance engineering

--Most of the 120,000 employed truck and bus work for fleet owners and transit companies.
--Other occupations in maintenance include parts clerking, foremanship, supervision and plant maintenance.

(6) Claims, safety and insurance

--Jobs in these categories involve training, investigation, security, and legal and regulatory knowledge.

(7) Accounting

--Occupations in accounting involve records, reports, billing, payrolls, rates, purchases, budgets and planning.

(8) Other occupational categories in the trucking industry include personnel, management, office occupations, advertising and public relations.

b. Some examples of careers with the railroad industry

(1) Communications coordinator
(2) Computer programmer
(3) Market analyst
(4) Account auditor
(5) Economist
(6) Operations analyst
(7) Radar operator
(8) Engineer
(9) Inspector
(10) Safety engineer
(11) Design engineer

c. Operational divisions of railroad systems

(1) Transportation
(2) Maintenance of way
(3) Mechanical
(4) Marketing
(5) Sales
(6) Communications
(7) Accounting
(8) Management

4. Occupations Relating to Taxi and Private Vehicle Usage

a. Operation of vehicle

(1) Garage and parking lot owners and attendants
(2) Fuel suppliers and employees
(3) Vehicle inspection and licensing personnel

b. Operation of service

(1) Drivers
(2) Radio dispatchers
(3) Office and clerical personnel

c. Maintenance of vehicle

(1) Auto mechanics
(2) Body repairmen
(3) Parts salespeople
(4) Car wash owners and employees

5. Occupations relating to Special Equipment, Recreational and Farm Vehicles

a. Many mobilized off-road and highway units classified into land transportation

(1) Some examples of construction and highway maintenance equipment that can be classified under land transportation:

--Grading machines
--Loading machines
--Backhoes
--Crawlers
--Graders
--Highway plows
--Snow blowers
--Rollers

(2) Some examples of farm equipment that can be classified under land transportation:

--Mowers
--Combines
--Wagons
--Balers
--Rakes
--Tractors

(3) Occupational categories associated in the special equipment areas:

--Engineering
--Manufacturing
--Marketing
--Distribution
--Retail sales and leasing
--Maintenance
--Operation
--Contracting
--Construction

(4) Examples of lightweight vehicles and recreational vehicles:

--Motorcycles, bicycles, motorbikes
--Scooters, mini bikes, go-carts
--Motorhomes, campers, dune buggies

(5) Examples of occupations represented by the manufacture and use of lightweight and recreational vehicles:

--Designers, airline operators, assembly workers
--Distributors, leaders, salespersons
--Repairmen, mechanics, servicemen

--Park managers, surveyors, land developers
--Managers, finance personnel, secretaries
--Safety experts, traffic police, environmentalists

6. Occupations Relating to Traffic Management

   a. Construction of highways and railways

      (1) Equipment operators
      (2) Drivers
      (3) Navigators
      (4) Planners
      (5) Attorneys
      (6) Secretaries
      (7) Mathematicians
      (8) Engineers
      (9) Foresters
      (10) Architects
      (11) Ironworkers
      (12) Carpenters
      (13) Weldors
      (14) Physicians
      (15) Traffic specialists
      (16) Law officers
      (17) Surveyors

   b. Workers employed in traffic control

      (1) Map makers
      (2) Toll personnel
      (3) State and local traffic patrol
      (4) Helicopter traffic monitor
      (5) Control device manufacturers
      (6) Sign makers and painters
      (7) Street and highway maintenance crews
      (8) Landscape designers
      (9) Emergency personnel

B. Suggested Teaching-Learning Activities

1. Arrange for an automechanics instructor from a local vocational school to present a topic to the class concerning power units and engines and the many related career opportunities.

2. Using graph paper for planning and scale drawing, have each student design a small vehicle for recreational or transportation purposes. Students should then list the following:

   a. Kinds of materials used in production

   b. All occupations involved in production and distribution

3. Have each student choose an occupation from one of the areas covered and prepare a class report.

4. Prepare a chart categorizing occupations relating to farm transportation equipment.

5. Invite an agriculture teacher to discuss the many transportation-related occupations that exist in agribusiness.

C. Suggested Evaluation

1. Have each student identify and discuss three specific occupations in land transportation: (1) an occupation which is restricted to land transportation--automechanic, lineworker, etc. (2) a profession which is not limited to transportation--lawyer, landscape designer, etc. and (3) a trade which is not limited to transportation--welder, electrician, etc. Students should be able to discuss the flexibility of the occupation (how adaptable is it to many work situations) and the importance of the position to transportation.

D. Suggested Resources

1. Books

   a. Occupations and Careers

   b. Occupational Outlook Handbook

2. Booklets

   a. "Food Careers"

   b. "Guide to Federal Career Literature"

3. Resource Persons

   a. Automechanic from local vocational school

   b. Agriculture teacher

II. The student will be able to describe the development of land transportation and analyze its importance to the economy.

A. Suggested Content

1. History of the Automobile

a. Automobile design and construction technology has advanced steadily in the 20th century.

(1) The first steam engine was developed by a Frenchman, Nicholal Gugnot, in 1796. It was experimentally used to propel a crude vehicle that achieved a top speed of three miles per hour.
(2) Two Englishmen developed a steam-propelled vehicle that could reach a speed of 15 miles per hour but was doomed due to the passage of the Red Flag Act in 1836.
(3) An electric car was built by an American, Thomas Davenport, in 1834.
(4) The first internal combustion engine was built by Joseph Lenior of France in 1863.
(5) The first successful gas-operated car to be built in the United States was built by Charles and Frank Duryea in 1893.
(6) The next five years involved several other American inventors:

--Elwood Haynes
--Jonathan Maxwell
--Apperson Brothers
--Charles King
--Henry Ford
--Alexander Winton
--Eli Olds

(7) Mass production in the 20th century widened the popularity and availability of automobiles. Henry Ford's "assembly line" methods proved to be highly effective.
Bodies were originally patterned after horse drawn carriages.

--Early service was poor.

-Blacksmiths did most of the frame repairs.
-Tinsmiths made sheet metal repairs.
-Cabinet-makers or carpenters made the wooden parts.

b. Beginnings of the auto body and fender repair trade found tools to be crude and awkward.

(1) The thirties brought the change from square box design to the streamline effect that is still in use today.

(2) Modern automobiles are elaborately equipped with comfort and safety features.

--Many models and styles are available.
--Of the 200 million automobiles in use in the world, about half are in the United States.

2. The Beginnings of the Trucking Industry

a. The concept of the "horseless carriage" relating to the automobile parallels the "horseless wagon" to the truck.

(1) Early trucks were limited in range and usefulness because of the lack of paved roadways. Only 700 trucks were in use in the U.S. in 1904.

b. After World War I, freight requirements increased and new highways were built.

(1) In 1929, 3 1/2 million trucks were in use. The trucking industry proved that it could move freight fast and efficiently. Currently there are 18 million trucks in use in the U.S.

c. Trucking plays a major role in transportation.

(1) Trucks move approximately 70% of the freight volume in the U.S. and this volume is projected to increase by 5% annually.
(2) Freight costs per ton mile of 7¢ plus for truck freight are exceeded only by air freight costs. Freight costs by water, rail and pipelines are cheaper.

d. Trucking services are important to communities in many ways.

(1) Refuse collection
(2) Fire protection
(3) Mail delivery
(4) Retail delivery
(5) Domestic and commercial moving
(6) Home servicing
(7) Bookmobiles
(8) Utilities
(9) Street cleaning

e. Business, industry and agriculture depend heavily on truck transportation for success.

(1) Truck-mounted working equipment
(2) Raw materials delivery
(3) Product movement
(4) Livestock and supply movement

f. There are as many styles and designs of trucks as are needed for specific purposes.

(1) One-piece trucks have the cab, engine and cargo space integrally designed on one chassis.

--Pick-up trucks
--Vans
--Panel trucks
--Stake trucks
--Moving vans
--Dump trucks

(2) Tractor-trailers

--Many special styles are used for different types of loads.

2. Employment of men and women in the trucking industry exceeds 8,000,000.

3. Farm transportation requirements represent a large segment of business in the transportation industry.

a. Agriculture operations have evolved from hand labor to total mechanization.

(1) The invention of the reaper by Cyrus McCormick in 1831 replaced the scythe and the sickle.
(2) The steel plough, created by the blacksmith John Deere in 1837, led the western world into a progressive agricultural revolution.

b. American farm equipment is used worldwide and has been copied and duplicated by most foreign manufacturers.

4. A sharp increase in the ownership and use of bicycles, motorcycles and recreational vehicles has occurred in the past decade.

a. A number of reasons contribute to this situation.

(1) There is an increase in availability of leisure time.
(2) The purchasing power and available money credit has encouraged people to pursue hobbies.
(3) Increased mobility makes recreation areas more accessible.
(4) Organizations such as cycle clubs, racing clubs, trail clubs and snowmobile clubs are popular.
(5) Lightweight, powered vehicles are usually operated economically.
(6) Small vehicles cause less congestion and produce less pollutants.

--Environmental damage has occurred through the use of trail vehicles.

(7) Bicycles are becoming extremely popular with people of all age groups.

--Bicycles are environmentally harmless.
--The source of energy is the muscle power of the rider, therefore fuel shortages have no affect.
--Bicycles are relatively safe and create few traffic problems.
--The construction of cycling lanes on many roads and highways in the U.S. is necessary.

(8) Self-propelled recreational vehicles are becoming increasingly popular.

--Families use them for vacationing and travel.
--Sportsmen, entertainment groups, construction workers, migrant workers and others use them for travel and temporary living quarters.

5. Expanded use of land transportation vehicles has created the need for development of highway systems.

a. The Romans were the first successful road builders.

(1) Fifty thousand miles of Roman-built highways extended across Europe, Asia and Africa.
(2) Many European highways and rail lines follow original routes established by Roman engineers 2000 years ago.
(3) The Roman roads were so well built that many still remain in good condition.

--These roads were built in layers, using stone slabs covered with Roman concrete, then filled with gravel and topped with a paving of basalt blocks.
--The roads were from 12 to 20 feet wide, had a crowned surface for a watershed and were edged on each side with drainage ditches.

(4) Other countries learned that roads would be durable only if they were protected from moisture; thus the Roman drainage system was copied.

b. The United States has the most extensive and best constructed highway system in the world.

(1) In 1908 there were 10,000 miles of hard-surface roads in the U.S.
(2) U.S. highway construction continues steadily adding to the two and one half billion miles now in use.

--By 1975, fifty thousand miles of the Interstate Highway System will be completed.
--In the city of Detroit alone, more than one third of the land area is paved.

(3) The development and maintenance of highway systems involves hundreds of various occupations.

6. History of the Railroad

a. James Watt (1736-1819) developed a powerful steam engine which because of its weight and bulk was suited to rail supported vehicles.

(1) Rail locomotives were in use as early as 1804.

--Early efforts included the use of horse drawn, sail and treadmill cars.

(2) George Stephenson's 1929 locomotive, The Rocket, was an efficient locomotive that could haul 52 tons of freight between Liverpool and Manchester, England in three hours. It achieved a top speed of 24 m.p.h.

b. About 1830, the United States had 28 miles of railroad.

(1) The first regularly scheduled service was provided by the Southern Railway's locomotive, "Best Friend of Charleston."

--The track covered six miles.
--Within three years the rails extended 136 miles from Charleston to Hamburg, South Carolina to form the longest railroad in the world.

c. America's railroad system expanded rapidly, proving its value to growth and economy.

(1) Charters had been authorized to 200 rail companies by 1835 and 1000 miles of track were in use.
(2) The Civil War interrupted growth and resulted in considerable destruction of railroad installations.
(3) In 1869 the first transcontinental railroads were connected at Promontory, Utah.
(4) After 1867 rail gauges were widely standardized.
(5) From 1880 and 1890, more than 70,000 miles of rail were laid.
(6) In 1925, the first diesel-electric locomotive was put into use as a switching unit.
(7) The first diesel locomotive used for passenger service in the U.S. (1935) was the famed Super Chief that ran between Chicago and Los Angeles - 2,226 miles in 40 hours.

d. Passenger service by railroad has steadily declined since 1945. Several conditions have contributed to this decline.

(1) Air travel is faster and costs per mile are less.
(2) Long distance bus travel has continued to be safe and comfortable.

(3) Rail freight service is inexpensive, requires fewer rail workers, and provides a higher profit to rail companies.

e. Modern railroad operation provides many employment opportunities.

(1) The freight business has become a coordinated effort of industry, all transportation systems, communication requirements and consumers.

(2) "Working on the railroad" in modern times requires special training.

B. Suggested Teaching-Learning Activities

1. Each student might prepare a biographical sketch of an individual who has contributed significantly to the success of the automobile industry. This could include inventors, designers, race drivers, corporation managers, or safety experts.

2. Ask a member of an antique automobile association to speak to the class about the history of automobiles.

3. Write a letter of inquiry to the American Trucking Association requesting educational materials and information about scheduled dates of local or regional truck rodeos. Students may wish to plan as a group or as individuals to attend one of these events.

4. Visit a local freight dock to observe its operation and gather information about representative occupations.

5. Invite a truck driver, a dispatcher or a terminal manager to visit the class and discuss occupations in the trucking industry.

6. Involve the student in a discussion of how the automobile (truck, railroad train, tractor) influenced the change in the American economy.

7. Involve the student in writing a short historical paper on the role of transportation in America in its early development as compared to today. See transparency masters, "Conestoga Wagon," p. 88 "Stagecoach," p. 89 "An Early U.S. Production Auto," p. 90 "The Model T Ford," p. 91 and Bicycle Transportation," p. 92.

8. Read and discuss current news articles concerning national economy that relates to transportation.

9. Construct a graph (for display) depicting the trends in economic growth and transportation activities in the United States.

10. Have each student list ten inventions related to land transportation and rank them according to importance.

11. Have a committee or team of students build cross-sectional models showing road bed construction. Materials to be used for this project include gravel of various small grades, sand, stone or marble chips to represent rock bases, scraps of cork sheet, scraps of textured materials such as vinyl, rubber, tile and construction board and various adhesives. See "Early Methods of Pavement Construction," pp. 93-94.

12. Write a letter to the United States Department of Transportation to obtain photographs or printings of newly designated federal traffic signs and markings. Back issues of the magazine Public Roads are also available as well as maps and brochures. See "Traffic Communication," p. 95.

13. Prepare a bulletin board display using photographs, magazine prints, and drawings to show the various types and uses of heavy equipment in highway construction.

14. Have each student select an occupation representative of highway design, construction or management and list job responsibilities, training requirements, earning potential and occupational outlook information. This information can usually be located in school libraries or the counselor's office.

15. Have each student select a highway connecting two cities in Kentucky or elsewhere and prepare a brief report citing three or more reasons why this transportation link is essential. See "Interstate Highways in Eastern and Central U.S.," p. 96, "Major Highways in Kentucky," p. 97, "Railroads Serving Kentucky," p. 98, and "National System of Interstate Highways," p. 99.

16. Invite a railroad representative or a retired employee to address the class on the topic of railroad careers. Make a tape recording of his presentation for further review and discussion.

17. Plan and conduct a class visit to a railroad museum. As a class project, ask students to bring two or three color slide cameras and film. Plan, photograph, edit and assemble a set of slides for further use with this topic. See "Horse-Drawn Railroad Car," p. 100, "Railroads in 1860," p. 101, "Box Cars for Moving Drygoods," p. 102, "Tank Cars for Moving Liquids," p. 103, and "Subway," p. 104.

C. Suggested Evaluation

1. The student will write a short paper outlining man's major stages of advancement in transportation. The paper will be evaluated according to the understanding of the total picture of transportation development.

D. Suggested Resources

1. Articles

   a. "Amtrak...The continuing saga of the vanishing American passenger train," Public Roads

   b. "The Man Who Met The Longhorns With a Railroad," Public Roads

   c. "Training...Southern Railway Makes It a Way of Life," Public Roads

2. Books

   a. Airplanes and Trucks and Trains - Fire Engines, Boats and Ships and Building and Wrecking Machines

   b. Cars and Motorcycles

   c. Cost of Transporting Freight

   d. Dead End: The Automobile in Mass Transportation

   e. The Death of the Automobile

   f. Highway Safety Occupational Program Developmental Guide

   g. Introduction to Transportation Planning

   h. Performance Data - New 1973 Passenger. Automobiles and Motorcycles

   i. Railways

   j. Technology - Creative Man Library/Vol. 1

3. Booklets

   a. "American Trucking Trends"

   b. "Crisis - Transportation

   c. "Directory of Transportation Education"

   d. "Employment Outlook for Driving Occupations"

   e. "Equal Opportunity at John Deere"

   f. "Highway Products"

g. "Highway Safety Occupational Program Development Guide"

h. "Highway-Traffic-Street Signs and Accessories"

i. "Highway and Development of International Harvester"

j. "How Meat Moves to Market"

k. "International M-Series Construction Trucks"

l. "Practical Driving Tips"

m. "Research and John Deere"

n. "Reynolds Aluminum Bridge Expansion Joints"

o. "Reynolds Aluminum for Highway Products"

p. "Reynolds Aluminum Highway, Traffic, Street Signs and Accessories"

q. "Southern Railway Company, Annual Report, 1972"

r. "Southern Railway System, Director of Employment"

s. "Southern Railway Company and Consolidated Subsidaries"

t. "Southern Railway Co., Employment Outlook for Rallroad"

u. "The Economics of Farm Products Transportation"

v. "The Steel Plough and the Company It Built"

w. "Transportation Careers"

x. "Truck Drivers Dictionary"

y. "Trucks and Things You'll Want to Know About Them"

z. "Facts & Functions"

aa. "Your World of Opportunity"

4. Charts

a. "A Car Is Born"

b. "Behind the Scenes with the Modern Southern"

c. "From the Southern's Picture Album"

d. "Ford on the American Road"

e. "Is Your Future in the Trucking Industry?"

f. "Is Your Future in the Trucking Industry?"

g. "Message to a Student Driver"

h. "Modern Special - Duty Cars for the Modern South"

5. Films

a. "Basic Blading"

b. "Road Ahead"

c. "There Will Be a Slight Delay"

6. Magazine

a. Public Roads, A Journal of Highway Research

7. Museums

a. Carillon Park Early Transportation Museum

b. Kentucky Railway Museum

c. Mt. Union Illinois Railroad Museum

d. National Museum of Transportation

8. Pamphlets

a. "A Car Is Born"

b. "A Concern For the Total Environment"

c. "Advertising"

d. "Cackle Crates, Bean Haulers and Six-Banger Semis"

e. "Cooperative Student Program"

f. "Economic Giant"

g. "Employee Benefit Program"

h. "Highball Ahead"

i. "How Trucks Serve You"

j. "Industrial Relations Personnel and Management Development"

k. "Inside Sale - Purchasing"

l. "International M-Series Construction Trucks"

m. "Management Principles"

n. "Manufacturing Engineering"

o. "Market Economics Reliability"

p. "Marketing - Agriculture"

q. "Marketing - Industrial"

r. "Occupational Outlook for Truck and Bus Mechanics"

s. "On the Road With the Truckers"

t. "Opportunities in the Trucking Industry"

u. "Opportunity for You as a Student Mechanic"

v. "Passenger Transportation"

w. "Product Engineering"

x. "Reynolds Aluminum Bridge Expansion Joints"

y. "Reynolds Aluminum for Tanks and Vessels"

z. "Serving the Community"

aa. "Skeins of Shoestrings"

bb. "Student Training Program"

cc. "Tech"

dd. "The Story of Southern Railway System"

ee. "Truck Route to the Future"

ff. "Welcome Aboard"

gg. "Wheels for America's Progress"

hh. "What Will It Be After High School"

9. Resource Persons

a. Dispatcher

b. Railroad representative

c. Retired railroad employee

d. Terminal manager

e. Truck driver

10. Transparency Masters

a. "Conestoga Wagon," p. 88

b. "Stagecoach," p. 89

c. "An Early U.S. Production Auto," p. 90

d. "The Model T Ford," p. 91

e. "Bicycle Transportation," p. 92

f. "Early Methods of Pavement," pp 93 & 94

g. "Traffic Communication," p. 95

h. "Interstate Highways in the Eastern and Central U.S.," p. 96

i. "Major Highway Network in Kentucky," p. 97

j. "Railroads Serving Kentucky," p. 98

k. "The National System of Interstate and Defense Highways," p. 99

l. "Horse-Drawn Railroad Car," p. 100

m. "Railroads in 1860," p. 101

n. "Box Cars Moving Dry Goods," p. 102

o. "Tank Cars for Moving Liquids," p.103

p. "Subway," p. 104

III. The student will be able to examine the employment trends and necessary skills outlook in land transportation.

A. Suggested Content

1. The amount of automobile production and sales has been on a continual increase.

   a. Eighty-one percent of the heads of households under 25 years of age owned at least one car in 1969.

   b. In 1940, for every 100 auto registrations there were 100 transit riders. In 1963, the ratio was 250.1 car registrations to 65.7 transit riders.

      (1) Recent fuel conservation measures may have a tendency to reverse this trend.

2. The total amount of freight transportation has been on the increase since 1950.

   a. Freight ton-miles almost doubled from 1950 to 1970.

      (1) Industrial production increased at an even more rapid rate.
      (2) An economic recession could have an impact on the total economy and freight transportation activity.
      (3) Of all freight hauled, three out of four tons move by truck. Truck manufacturing annually consumes the following:

      -- 63,000,000 lbs of aluminum
      --118,000,000 lbs of copper
      -- 9,000,000 gallons of paint and thinner
      -- 40,000,000 square feet of glass

      (4) Truck operations annually requires the following:

      -- 1,500,000,000 quarts of oil
      -- 1,200,000 tons of rubber
      -- 26,000,000 tires
      -- 31,300,000 gallons of antifreeze
      --23,500,000,000 gallons of fuel

      (5) The trucking industry's annual expenditures approaches $74,300,000,000, of which $5,300,000,000 are highway use taxes.

      (6) A ton-mile is one ton moved one mile. Trucks haul 404,000,000,000 ton-miles of freight annually.

   b. Land transportation accounts for 60% of all freight transportation volume.

(1) Trucking - 22%
(2) Railroad - 30%

c. Projected freight transportation volume is on the increase.

(1) Trucking volume should increase at a rate of almost 5% up to 1975.

--This rate will average out to about a 4.25% yearly increase over the 1971-1980 span.

(2) Railroad volume should increase by almost 4% until 1975.

--The average annual rate over the 1971-1980 span will be less than 0.5%.

d. Railroad employment declined slightly during the early part of this decade (1970's).

Note: In order to develop the ability to gain insight into the employment trends and skills outlook, the student must be able to investigate existing local and national situations and diagnose trends. Factors which cause change in employment outlook and skills required should be examined as well as jobs which are in growing demand. The student should devise a list of questions which will enable him to more skillfully render an employment forecast.

3. What land transportation industries are there?

a. Locally

b. At some other desirable locale

4. Which industries appear to be expanding?

a. Is there a chance of over expansion?

5. What is the age composition of the employees?

a. Are there going to be jobs being created through retirement?

6. What are the basic skill requirements?

a. What new skills may be needed?

7. How may automation and technology affect the industry or the position?

8. How will population growth affect the industry?

B. Suggested Teaching-Learning Activities

1. Establish a list of all new industries to enter the locality within the last ten years. Analyze the list as it relates to land transportation and try to determine the number of new land transportation jobs that have become available.

2. Establish a list of all industries lost to the area in the last ten years. How many land transportation jobs were lost?

3. Compare the two lists and determine the net effects upon land transportation.

4. Determine which new industries are interested in or planning to move into the area. How will this affect land transportation? (The Chamber of Commerce and the State Employment Office may be of help. Both teacher and student should be alert to items in the news on outlook for employment in land transportation jobs.)

5. Have each student locate five job openings for a land transportation worker. These should be real rather than fictitious. Use newspaper ads, employment office bulletins, civil service announcements, etc.

6. Have an employment couselor, a personnel man, the mayor, or an informed businessman discuss with the students the employment outlook in the state.

7. Have students interview adults and compile two lists.

   a. What skills are performed now but were not in operation ten years ago?

      (1) Twenty-five years ago?

   b. What skills were needed ten years ago, but are not needed now?

      (1) Twenty-five years ago?

8. Have the students compare current form equipment with that which is twenty-five years old.

   a. Compare road grading equipment.

   b. Compare automobiles and trucks with twenty-five year old models.

      (1) Accessories

9. Have students speculate on how they believe land freight will move in the future.

10. Students should examine and analyze specific trends in land transportation and attempt to make projections about employment futures in these areas. See "Index of Trends," p. 105, "Household Car Ownership Patterns," p. 106, "Mean Annual Mileage," p. 107, "Economic Activity and Freight Transportation," p. 108, "Estimated Freight Transportation Volume," p. 109, and "Projected Freight Transportation Volume," p. 110.

C. Suggested Evaluation

1. Have the students discuss several kinds of land transportation jobs that will be in demand in the 1970's and 1980's. Base the evaluation on information gathered concerning the employment outlook.

D. Suggested Resources

1. Books

   a. Occupational Outlook Handbook

2. Booklets

   a. "Occupational Outlook for Truck and Bus Mechanics"

3. Resource Persons

   a. Businessman

   b. Employment counselor

   c. Mayor

   d. Personnel man

IV. The student will be able to describe, in depth, at least two land transportation jobs.

A. Suggested Content

1. Auto Mechanic

a. Employment outlook

(1) In 1970, 600,000 mechanics were employed.

--Most of these were employed in independent repair shops as specialized or general mechanics.
--A small number were employed by department stores and chain stores.
--Many were employed by new car dealers.
--The average shop employs from one to five mechanics, but some of the largest shops employ more than one hundred.

(2) Each year, as replacements, 8,600 jobs are expected.
(3) The energy crisis may have some long range effects upon the automotive industry.

b. Earning and working conditions

(1) Salaries averaged $3.62 - $6.13 across the country in late 1969.
(2) General mechanics and specialists generally earn more.
(3) Some mechanics are paid a commission. Usually 50% of the labor cost, charged to the customer.
(4) Many employers provide paid vacations, insurance, retirement and laundered uniforms.
(5) Generally the mechanic's work is performed indoors in well lighted, heated and ventilated areas.
(6) Minor cuts and bruises are common.
(7) Serious accidents are avoided by practicing safety rules.
(8) In larger cities some mechanics may be members of labor unions.
(9) Mechanics provide own hand tools.

c. Educational requirements

(1) Most mechanics learn the trade through "on-the-job" experience.
(2) Trainees usually start in service stations as helpers, lube men or attendants.
(3) Approximately four years are required to learn the trade on the job, with 1 1/2 to 2 years required for specialization.
(4) A considerable amount of training is available in the military services.
(5) Others receive training in vocational and trade schools.

--Work study programs

--Co-op programs
--Full time vocational student
--Factory sponsored programs

d. Special knowledge, skills and ability requirements

(1) Thorough knowledge of tools, materials, techniques and equipment used in the trade

--Front wheel aligner
--Wheel balancer
--Battery changer
--Hydraulic floor jack
--Micrometer
--Wrenches
--Grease gun
--Caliper

(2) Thorough knowledge of all systems of the automobile

--Cooling and heating
--Electrical
--Wheels and tires
--Steering and suspension
--Brakes
--Engines
--Fuel, exhaust and emissions
--Drive train

(3) Thorough knowledge of related subjects

--Communication skills
--Mathematics
--Circuit analysis, schematics, sketching
--Blueprint reading

e. Advancement possibilities

(1) Experienced mechanics are continually being upgraded by attending factory schools and clinics.
(2) Experienced mechanics may advance in the following ways:

--Shop foremen
--Service managers
--Ownership
--Instructor

2. Motor Vehicle Inspector for Commonwealth of Kentucky

a. Earnings (April 1974)

(1) Beginning annual salary $6,360
(2) Longevity rate $8,940

b. Job characteristics and duties

(1) Coordinates and investigates motor vehicle inspection stations
(2) Coordinates the work of mechanics-inspectors
(3) Prepares and maintains records and reports pertaining to operations of stations and performance of personnel
(4) Processes applications of operators and mechanics
(5) Checks sticker fees

c. Educational requirements

(1) Accredited high school graduate
(2) Four years experience

--Automotive law enforcement
--Business administration

d. Special knowledge, skills and abilities

(1) Thorough knowledge of Kentucky Motor Vehicle Inspection Act
(2) Good judgement
(3) Public speaking ability
(4) Ability to deal with the general public

3. Auto Body Repair Person

a. Employment outlook

(1) As long as the automobile remains our chief source of transportation, there will be a demand for repair people.
(2) Most repairmen are employed in independent shops.
(3) Many are employed by new and used car dealers.

b. Earnings and working conditions (April 1974)

(1) Salaries ranged from $2.30 to $10.00 across the country.
(2) The work is generally performed indoors in well lighted, heated and ventilated areas.
(3) Some repairmen may specialize as spray artisans.

c. Job characteristics and duties

(1) Repairs any damage to frame or body of vehicle

--May replace severely damaged body parts

(2) Does necessary straightening, reinforcing or repairing of body and frames
(3) May build up body surfaces with body filler
(4) Prepares surfaces for painting by scraping, filling and sanding

(5) Masks off areas which are not to be sprayed with newspaper and masking tape
(6) Paints repaired body surfaces with spray gun
(7) Buffs and finishes body surfaces

d. Educational requirements

(1) Four years of training and experience is usually required to become skilled at trade.
(2) Training may be acquired through:

--Vocational schools
--On-the-job training
--Military schools

e. Special knowledge, skills and abilities

(1) Thorough knowledge of tools, materials, techniques, and equipment

--Oxy-acetylene torch
--Spray gun compressor

(2) Skill in technique of spraying
(3) Skill in technique of welding
(4) General ability to recognize the extent of damage to frame and body of vehicle
(5) Considerable knowledge of paints, varnishes, shellac, driers and fillers

4. Diesel Mechanic

a. Earnings (1974)

(1) Beginning salary $4.00/hr.
(2) Longevity rate $6.00/hr.

b. Job characteristics and duties

(1) Diagnoses mechanical trouble and makes needed repairs and adjustments on heavy equipment

--Earth movers
--Heavy trucks
--Graders
--Bulldozers
--Power shovels

(2) Repairs special items of mechanical, electrical, hydraulic and pneumatic equipment
(3) Overhauls motors
(4) Repairs transmissions and other assemblies
(5) Limited welding
(6) Operates and tests equipment

c. Educational requirements

(1) Basic auto mechanics training

--4 years

(2) One year of diesel mechanics

d. Special knowledge, skills, and abilities

(1) Thorough knowledge of materials and skills required of auto mechanics
(2) Knowledge of a wide variety of diesel-powered equipment

5. Motor Transportation Assistant Director for Commonwealth of Kentucky

a. Earnings (April 1974)

(1) Beginning annual salary - $9,384
(2) Longevity rate - $13,200

b. Job characteristics and duties

(1) Highly responsible administrative work involving direction of a divisional program
(2) Performance of management functions
(3) Interprets administrative policy to subordinates
(4) Directs the preparation of reports on:

--revenue collection
--enforcement activities
--rates and service activities

(5) Has authority in absence of division director

c. Educational requirements

(1) Baccalaureate degree from accredited colleges or university
(2) 2 years of progressive responsible experience in:

--Inspection
--Investigation
--Related work

(3) Or graduate of recognized law school

d. Special knowledge, skills and abilities

(1) Thorough knowledge of the division concerning

--Subject matter
--Functions
--Procedures
--Organizations
--Regulations

(2) Ability to organize and review work of subordinates
(3) Ability to meet and deal with other administrators
(4) Ability to meet and deal with the general public

e. Advancement Possibilities

(1) Motor Transportation Director

6. Training for Careers in Railroad Occupations

a. Goals of company training programs

(1) Improves productivity
(2) Strengthens skills of employees
(3) Develops greater job satisfaction
(4) Builds more successful careers

b. Phases of operations represented in training programs

(1) Shopcrafts: Under union agreement basic skill training for student mechanics, electricians, machinists, boilermakers, blacksmiths, pipefitters and carmen
(2) Communications and Signals: Upgrading training for all communication and signal craftsmen
(3) Switchmen Training: As an integral part of initial job experience, this program covers the rules and regulations of train operations, with emphasis on safety
(4) Locomotive Engineers: Selection and training of candidates on a consistant basis
(5) Management Training: Ongoing programs to upgrade supervisors, foremen, trainmasters, sales engineers, terminal superintendents and other middle managers

c. Areas of emphasis on training programs

(1) Technical skills development
(2) Communication skills improvement
(3) Motivation improvement
(4) Individual instruction
(5) Live action training situations
(6) Problem-solving

d. The railroad industry supports additional educational programs

(1) Cooperative work study programs
(2) Employer reimbursement college programs
(3) Seminars, workshops, special programs

B. Suggested Teaching-Learning Activities

1. Each student might choose one or more occupations related to the

automotive industry to be explored by identifying facts as presented in this lesson.

2. A class reference notebook could be assembled containing several occupational outlines.

3. Students could bring in toys such as the "Visible V-8 Engine" or the "Visible Wankel Engine" which could be assembled in the classroom.

4. Students will be supplied with a small piece of sheet metal upon which they may apply the auto body techniques and turn it into something useful (hot plate, ash tray). They will engage in applying filler, sanding, spraying, and finishing the piece.

5. The students will be divided into small groups of four or five with one student from each group selected to act as manager or administrator. Each team will be supplied with construction paper, a ruler, a pair of scissors, a ball point pen, a pencil, and a roll of tape.

   a. The teacher will supply the manager of each group with the diagram of a jeep (See "Construct a Jeep From a Set of Boxes" p.111) that is to be constructed from a series of various size boxes. The manager is to direct the construction of the boxes and the assembly of the final product (the jeep). He will not be permitted to participate in the actual work, and he will not be permitted to tell the other students exactly what it is that they are making. This will heighten the interest as the other students are allowed to "discover" what it is that they are making.

   b. The teacher will be allowed to give the administrators instructions before the game begins, the amount of instruction being left to the teachers discretion. Perhaps the team that operates along an assembly line basis, with one person doing layout, another cutting, and another folding and taping, will be most effective. The fastest, most efficient team wins. Neatness counts.

C. Suggested Evaluation

1. Have the students present oral occupational information reports, either as teams or individually, allowing the other class members to ask pertinent questions and/or take appropriate notes.

D. Suggested Resources

1. Books

   a. Automotive Service Occupations

   b. John Leverson, Auto Mechanic

c. Occupations and Careers

2. Booklets

   a. "Careers"

   b. "Directory of Transportation Education"

   c. "Occupations in Transportation"

   d. "Transportation Careers"

   e. "U.S. Department of Transportation"

3. Charts

   a. "Automobile Progress"

   b. "Automotive Service Job Opportunities"

4. Films

   a. "ABC of Automobile Engines"

   b. "At your Service"

   c. "Auto Mechanic and Technician"

   d. "Auto Mechanic: 'It's for You"

   e. "Body Builders"

   f. "Occupation: Auto Mechanic"

   g. "Transportation Go-How--Motor Carrier"

   h. "Trucks and Your Town"

5. Transparency Master

   a. "Construct a Jeep," p. 111 & 112

SUPPORTIVE MATERIAL

FOR

UNIT TWO

79/80

REFERENCE LIST FOR UNIT TWO

ARTICLES

1. "Amtrak...The continuing saga of the vanishing American passenger train," Joseph Zucker. The Elks Magazine. 1971

2. "The Man Who Met The Longhorns With a Railroad," Nations Business, January 1971

3. "Training...Southern Railway Makes It a Way of Life," Reprinted from the July-August, 1972 issue of Progressive Railroading

BOOKS

1. Airplanes and Trucks and Trains, Fire Engines, Boats and Ships, and Building and Wrecking Machines by George Zaffo, Grosset and Dunlap

2. Automotive Service Occupations United States Government Printing Office.

3. Cars and Motorcycles U.S. Department of Transportation

4. Cost of Transporting Freight Interstate Commerce Commission, Bureau of Accounts, May 1972

5. Dead End: The Automobile in Mass Transportation by Ronald A. Buel, Prentice-Hall, Inc. 1972

6. The Death of the Automobile by John Jerome, W.W. Norton & Company Inc., 1972

7. Highway Safety Occupational Program Developmental Guide by Ronald D. Daugherty, W. Kent Brooks and Carroll R. Hyder. The Center for Vocational and Technical Education. The Ohio State University

8. John Leverson, Auto Mechanic Follet Publishing Company, 1965

9. Occupational Outlook Handbook United States Government Printing Office

10. Occupations and Careers by Feingold and Swerdloff, Webster Division, McGraw Book Company, 1969

11. Performance Data - New 1973 Passenger--Automobiles and Motorcycles, U.S. Department of Transportation

12. Railways by Howard Laxton, Paul Hamlyn Ltd., 1963

13. Technology - Creative Man Library/Vol. I Charles E. Merrill Publishing Company, 1968

BOOKLETS

1. "American Trucking Trends," American Trucking Association

2. "The Back-and-Forth and Round-and-Round Discovery Book," Curtiss Wright

3. "A Car Is Born," Ford Educational Affairs Department, The American Road

4. "Careers," Ford, Educational Affairs Department, The American Road

5. "Crisis - Transportation," Caterpillar

6. "Directory of Transportation Education," Public Relations Department American Trucking Associations, Inc.

7. "The Economics of Farm Products Transportation," Marketing Research Report No. 843. Economic Research Service, U.S. Department of Agriculture

8. "Employment Outlook for Driving Occupations," Occupational Outlook Handbook 1972-73 ed., U.S. Department of Labor, Bureau of Labor Statistics.

9. "Equal Opportunity at John Deere," John Deere Co.

10. "Guide to Federal Career Literature," U.S. Civil Service Commission, U.S. Government Printing Office

11. "Highway Products," Manager, HIghway Market, Reynolds Metals Company

12. "Highway Safety Occupational Program Development Guide," Ronald D. Daugherty, W. Kent Brooks, Carroll R. Hyder. The Center for Vocational and Technical Education. The Ohio State University. July, 1971

13. "Highway-Traffic-Street Signs and Accessories," Reynolds Metal Company

14. "History and Development of International Harvester," General Office

15. "How Meat Moves to Market," Swift and Company

16. "International M-Series Construction Trucks," International Harvester Company

17. "An Introduction to the Automotive Electrical System, Delco-Remy Division, Technical Literature Section

18. "Kaiser Cement - Types and Uses," Kaiser Cement

19. "The Making of Portland Cement," Portland Cement Association

20. "Marketing, Industrial," Deere & Company

21. "Merchandising Your Job Talents," U.S. Department of Labor, Manpower Administration

22. "Mirawol," Kaiser Aluminum and Chemical Sales, Inc.

23. "Occupational Outlook for Truck and Bus Mechanics," American Trucking Association

24. "Occupations in Transportation," ERIC Clearinghouse on Vocational and Technical Education. The Center for Vocational and Technical Education. The Ohio State University

25. "Practical Driving Tips," Public Relations Department, American Trucking Associations, Inc.

26. "Product Engineering," Deere & Company

27. "Research and John Deere," John Deere Co.

28. "Reynolds Aluminum Bridge Expansion Joints," Manager, Highway Markets. Reynolds Metals Company

29. "Reynolds Aluminum for Highway Products," Manager, Highway Markets, Reynolds Metals Company

30. "Reynolds Aluminum Highway, Traffic, Street Signs and Accessories," Reynolds Metal Company

31. "Southern Railway Company, Annual Report, 1972," Public Relations Department, Southern Railway Company

32. "Southern Railway System," Director of Employment, Southern Railway Company

33. "Southern Railway Company and Consolidated Subsidaries," 1972 Statistical Report

34. "Souther Railway Company, Employment Outlook for Railroad," Superintendent of Documents, U.S. Government Printing Office

35. "The Steel Plough and the Company It Built," John Deere Co.

36. "Transportation Careers," Delta Nu Alpha Transportation Fraternity, National Headquarters

37. "Truck Drivers Dictionary," Jean M. Walker, Chief, Education Section American Trucking Association

38. "Trucks and Things You'll Want to Know About Them," Educational Services, Public Relations Department, American Trucking Association

39. "U.S. Department of Transportation," Superintendent of Documents, U.S. Government Printing Office

40. "U.S. Department of Transportation - Facts & Functions," Department of Transportation, Office of the Secretary

41. "Wheels for America's Progress," American Trucking Association, Inc.

42. "Your World of Opportunity," International Harvester Company.

CHARTS

1. "Automobile Progress," General Motors Corporation

2. "Automotive Service Job Opportunities," Automotive Service Industry Association

3. "Behind the Scenes with the Modern Southern," Southern Railway System

4. "A Car Is Born," Ford Educational Affairs Department

5. "Delco-Remy Training Charts," Delco-Remy Division

6. "Detroit Diesel Engine Instruction Charts," Detroit Diesel Engine Division, Sales Training Program, Development Department

7. "Ford On The American Road," Ford Motor Company

8. "From the Southern's Picture Album," Southern Railway System

9. "Is Your Future in the Trucking Industry?" The B.F. Goodrich Company and the ATA Foundation - Public Relations

10. "Is Your Future in the Trucking Industry?" American Trucking Association

11. "Message to a Student Driver," The B.F. Goodrich Company, Public Relations

12. "Modern Special - Duty Cars for the Modern South," Southern Railway System

FILMS

1. "ABC of the Automobile Engine," 16mm, General Motors Corporation
2. "ABC of the Diesel Engine," 16mm, General Motors Corporation
3. "ABC of Internal Combustion," 16mm, General Motors Corporation
4. "ABC of Jet Propulsion," 16mm, General Motors Corporation
5. "An Introduction to the Automotive Electrical System," 35 mm, Delco-Remy Division
6. "At Your Service," 16mm, Mercedes-Benz Film Library, 1968
7. "Auto Mechanic and Technician," 16mm, Ford Motor Service
8. "Auto Mechanic: It's For You," 16mm, Modern Talking Picture Service
9. "Basic Blading," 16mm, Modern Talking Picture Service
10. "Body Builders," 16mm, General Motors Corporation, 1970
11. "Occupation: Auto Mechanic," General Motors Corporation
12. "Road Ahead," 16mm, Caterpillar Film Library, Modern Talking Picture Service
13. "There Will Be a Slight Delay," Purchase, Caterpillar Tractor Co., Miscellaneous Material Orders, AB5C
14. "Transportation Go-How--Motor Carrier," 16mm, Eastern Express, Inc., 1966
15. "Trucks and Your Town," 16mm, Ringsley United, 1964

MAGAZINE

1. "Public Roads," A Journal of Highway Research. U.S. Department of Transportation. Federal Highway Administration

PAMPHLETS

1. "A Car Is Born," Ford Educational Affairs Department. The American Road

2. "A Concern For the Total Environment," John Deere Co.

3. "Advertising," John Deere Co.

4. "Cackle Crates, Bean Haulers and Six-Banger Semis," Public Relations Department. American Trucking Association, Inc.

5. "Cooperative Student Program," John Deere Co.

6. "Economic Giant," American Trucking Association

7. "Employee Benefit Program," John Deere Co.

8. "Highball Ahead," Standard Oil Co. of California. Public Relations Department, American Trucking Associations, Inc.

9. "How Trucks Serve You," Education Section, American Trucking Associations Inc.

10. "Industrial Relations Personnel and Management Development," John Deere Co.

11. "Inside Sale - Purchasing," John Deere Co.

12. "International M-Series Construction Trucks," International Harvester Company

13. "Management Principles," John Deere Company

14. "Manufacturing Engineering," John Deere Company

15. "Market Economics Reliability," John Deere Company

16. "Marketing - Agriculture," John Deere Company

17. "Marketing - Industrial," John Deere Company

18. "Occupational Outlook for Truck and Bus Mechanics," Occupational Outlook Handbook of the U.S. Department of Labor

19. "On The Road With The Truckers," The Education Section, American Trucking Associations, Inc.

20. "Opportunities in the Trucking Industry," American Trucking Associations, Inc.

21. "Opportunity For You As A Student Mechanic," Southern Railway System

22. "Passenger Transportation," Conference Board

23. "Product Engineering," John Deere Company

24. "Reynolds Aluminum Bridge Expansion Joints," Manager, Highway Markets, Reynolds Metals Company

25. "Reynolds Aluminum for Tanks and Vessels," Reynolds Metal Company

26. "Serving the Community," Educational Services, Public Relations Department, American Trucking Association, Inc.

27. "Skeins of Shoestrings," Wards Auto World

28. "The Story of Southern Railway System," Southern Railway System

29. "Student Training Program," John Deere Company

30. "Tech.," John Deere Company

31. "Truck Route To The Future," American Trucking Associations, Inc.

32. "Welcome Aboard," Southern Railway System

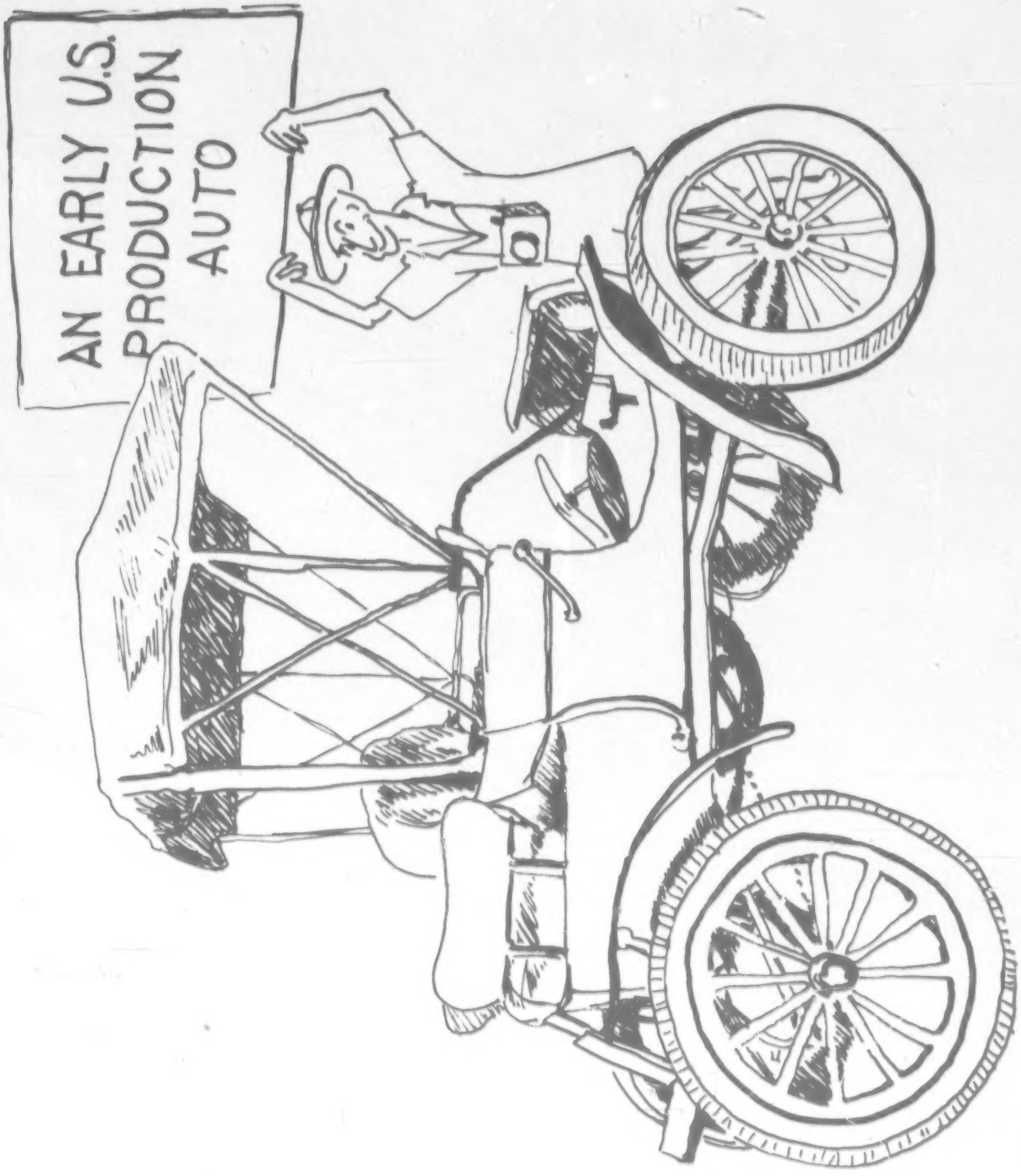
33. "Wheels for America's Progress," American Trucking Associations

34. "What Will It Be After High School," John Deere Company

PHIPPS-STOUT, CURR. DEV. CNTR., U.K. 993-25

CONESTOGA WAGON

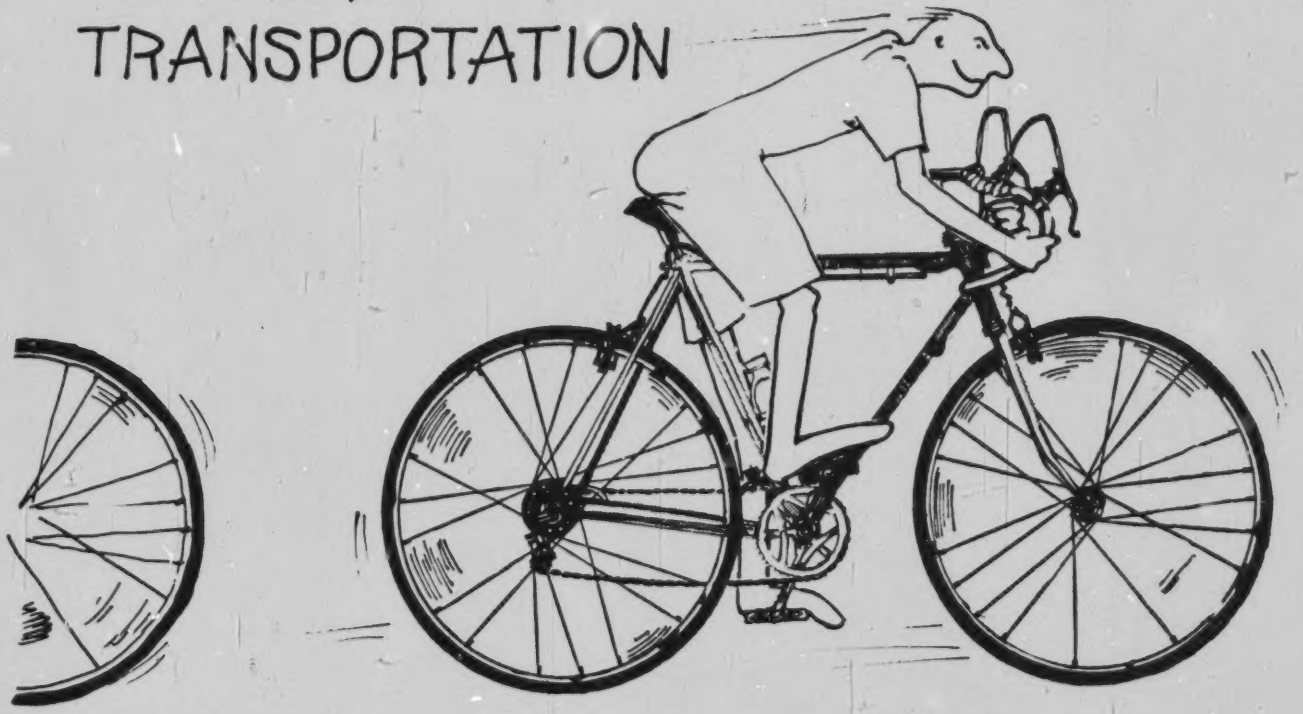
STAGECOACH



PHIPPS - STOUT, CURR. DEV. CNTR., U.K. 993-23

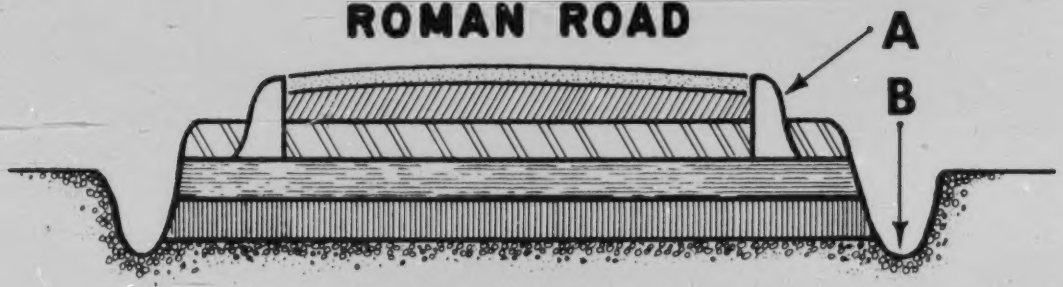
HIPPS - STOUT : CURR DEV. CNTR., U.K. 993-19

BICYCLE TRANSPORTATION



EARLY METHODS OF PAVEMENT CONSTRUCTION

ROMAN ROAD



A RETAINING STONES

B DRAINAGE DITCH

STONE WEARING COURSE

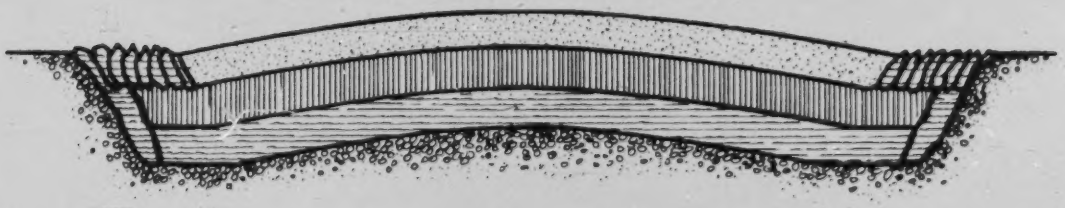
CAMBERED HARD FILLING

ROMAN CONCRETE

WATERPROOFED STONES

RETAINING STONES

MAC ADAM'S ROAD



WEARING SURFACE

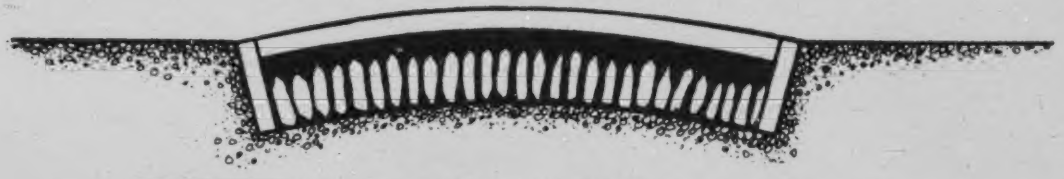
BASE COURSE

FOOTING

R GILMORE CURR DEVE CNTR UK 1013-4

EARLY METHODS OF PAVEMENT CONSTRUCTION

18TH CENTURY FRENCH ROAD

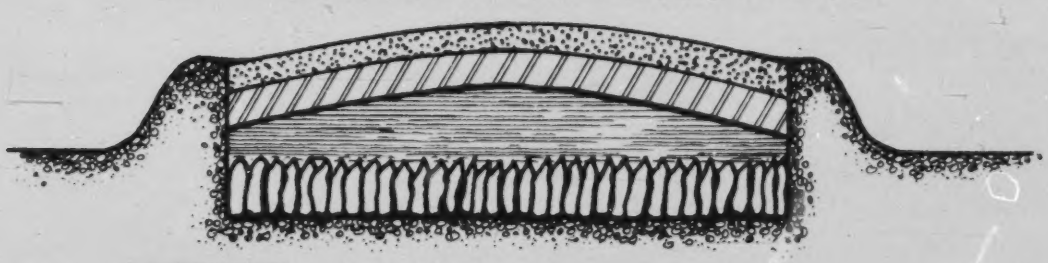


3 1/2-INCH SMALL STONE SURFACE

6 3/4-INCH LARGE STONE COURSE

HEAVY STONE FOUNDATION

18TH CENTURY BRITISH ROAD



GRAVEL SURFACE

TWO LAYERS OF STONES TOTAL 20" THICKNESS

6 3/4 INCHES OF HEAVY STONES

TRAFFIC COMMUNICATION

INTERSTATE HIGHWAYS IN THE EASTERN & CENTRAL U.S

"Industrial Resources - Kentucky"
Kentucky Department of Commerce, 1972

R.G. CURR. DEVE. CNTR. UK 1003-4

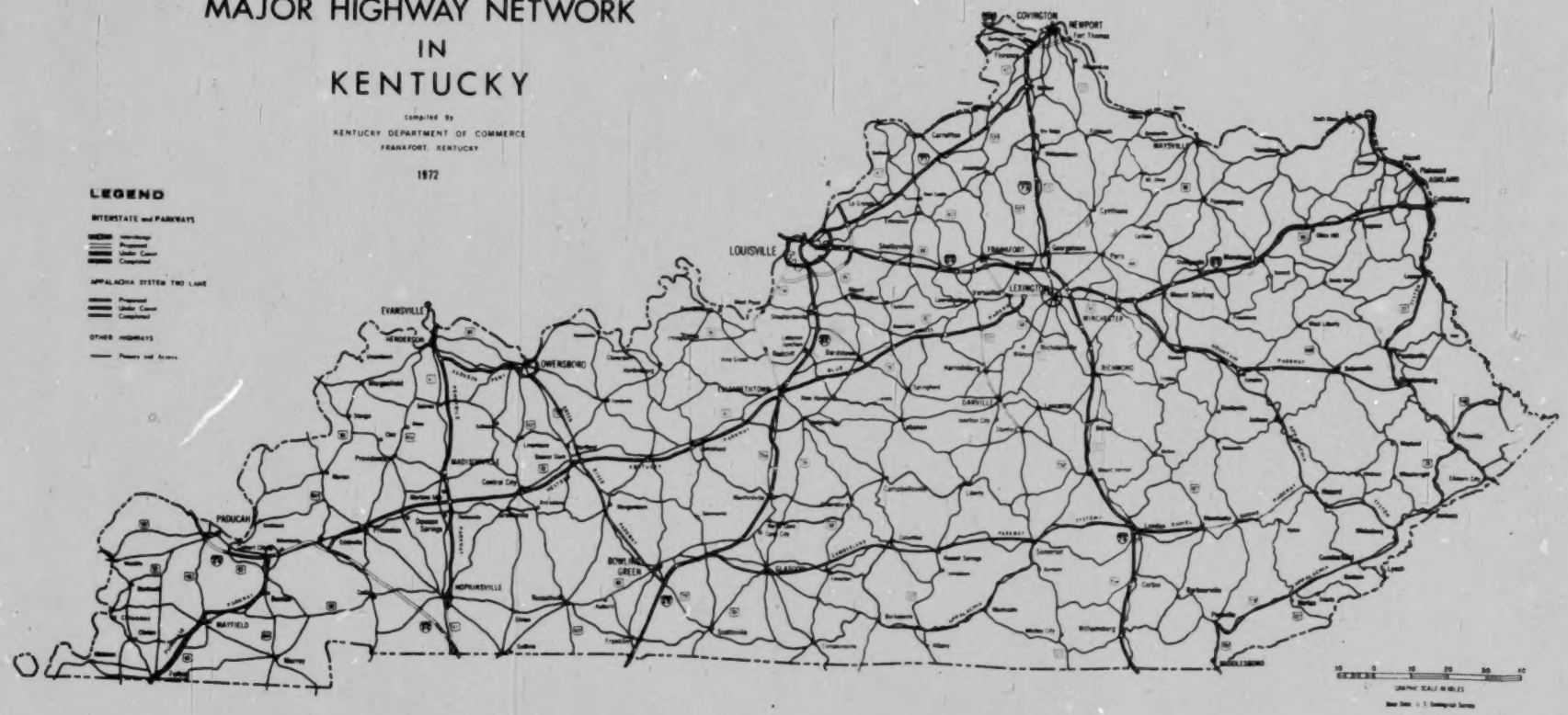
KG CURR. DEVE. CNTR. UK. 1013-2

97

MAJOR HIGHWAY NETWORK IN KENTUCKY

compiled by
KENTUCKY DEPARTMENT OF COMMERCE
FRANKFORT, KENTUCKY

1972



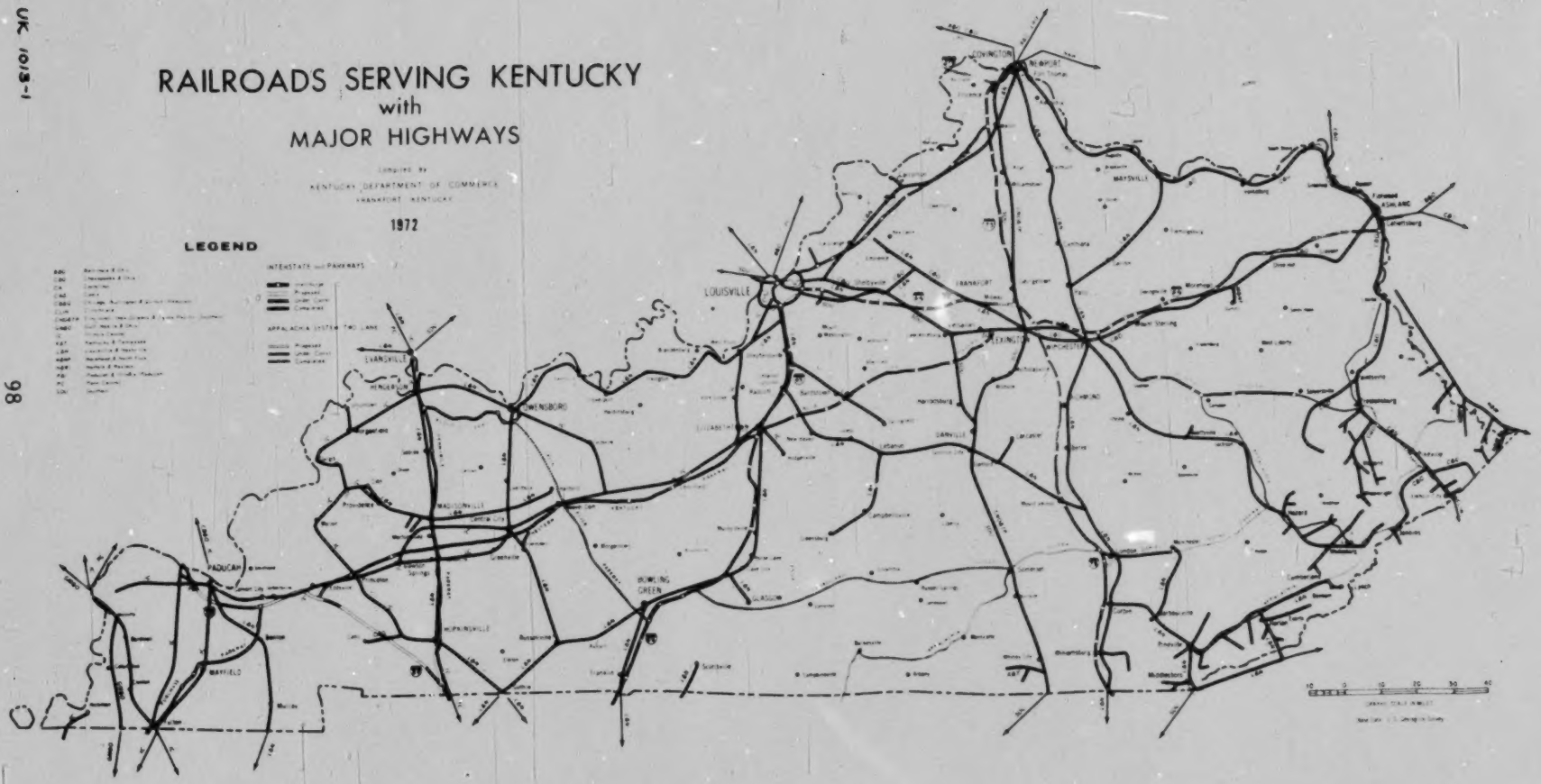
"Industrial Resources - Kentucky"
Kentucky Department of Commerce, 1972

KY. CURR. DOC. CNTR. UK. 1013-1

RAILROADS SERVING KENTUCKY
with
MAJOR HIGHWAYS

issued by
KENTUCKY DEPARTMENT OF COMMERCE
FRANKFORT, KENTUCKY

1972



"Industrial Resources - Kentucky"
Kentucky Department of Commerce, 1972

RG CARE ASVE CATE LK 1013-3

THE NATIONAL SYSTEM OF INTERSTATE AND DEFENSE HIGHWAYS

STATUS OF IMPROVEMENT AS OF JUNE 30, 1972

HAWAII
OAHU
COMPLETED OR IMPROVED AND OPEN TO TRAFFIC
Completed to full or acceptable standards, or improved to standards adequate for present traffic, built with Interstate or other public funds
MAJOR TOLL ROADS
Incorporated in the Interstate System
UNDER CONSTRUCTION
PRELIMINARY STATUS OR NOT YET IN PROGRESS
Plan preparation and right-of-way acquisition completed or underway on many portions of these sections
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

Preliminary Status or Not Yet in Progress	Engineering and Right-of-Way in Progress	Under Construction	Open to Traffic
1424 Miles	3778 Miles	3776 Miles	33522 Miles

37298 Miles

INTERSTATE TOTAL 42,500 MILES

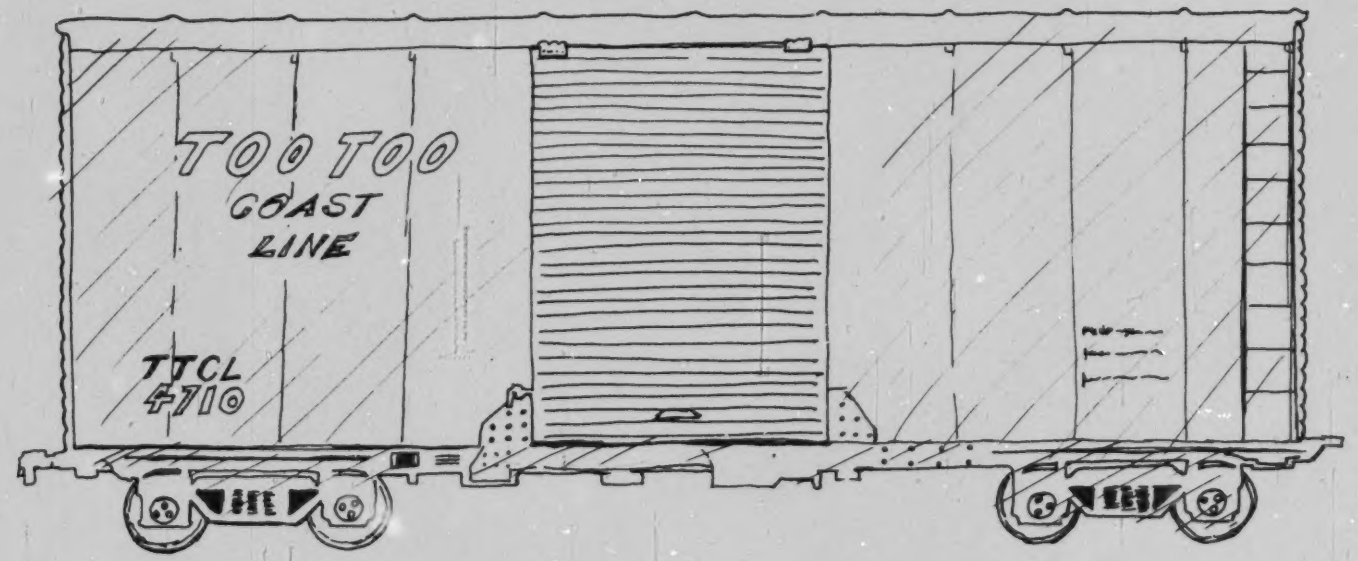
U. S. GOVERNMENT PRINTING OFFICE : 1972 O - 472-822

HORSE-DRAWN RAILROAD CAR

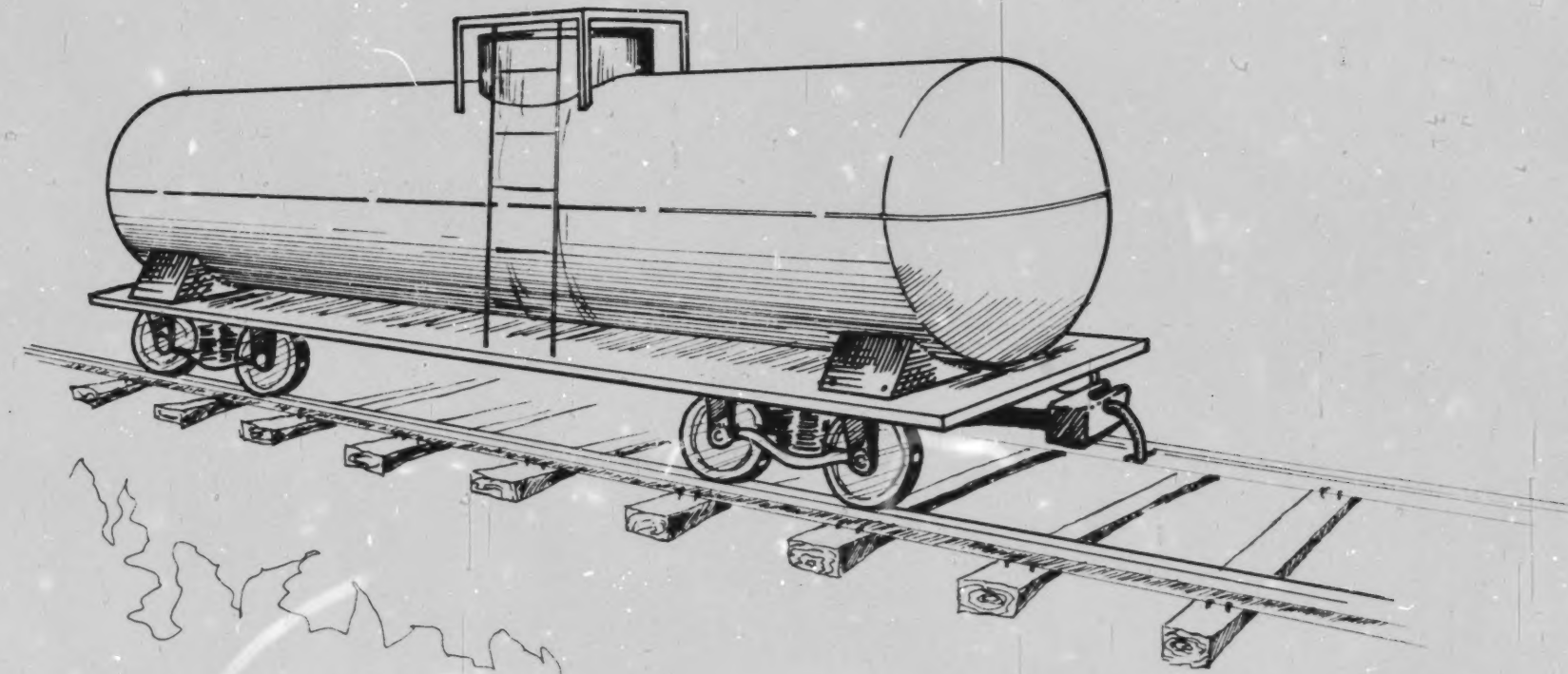
PHIPPS-STOUT : CURR. DEV. CNTR., U.K. 993-17

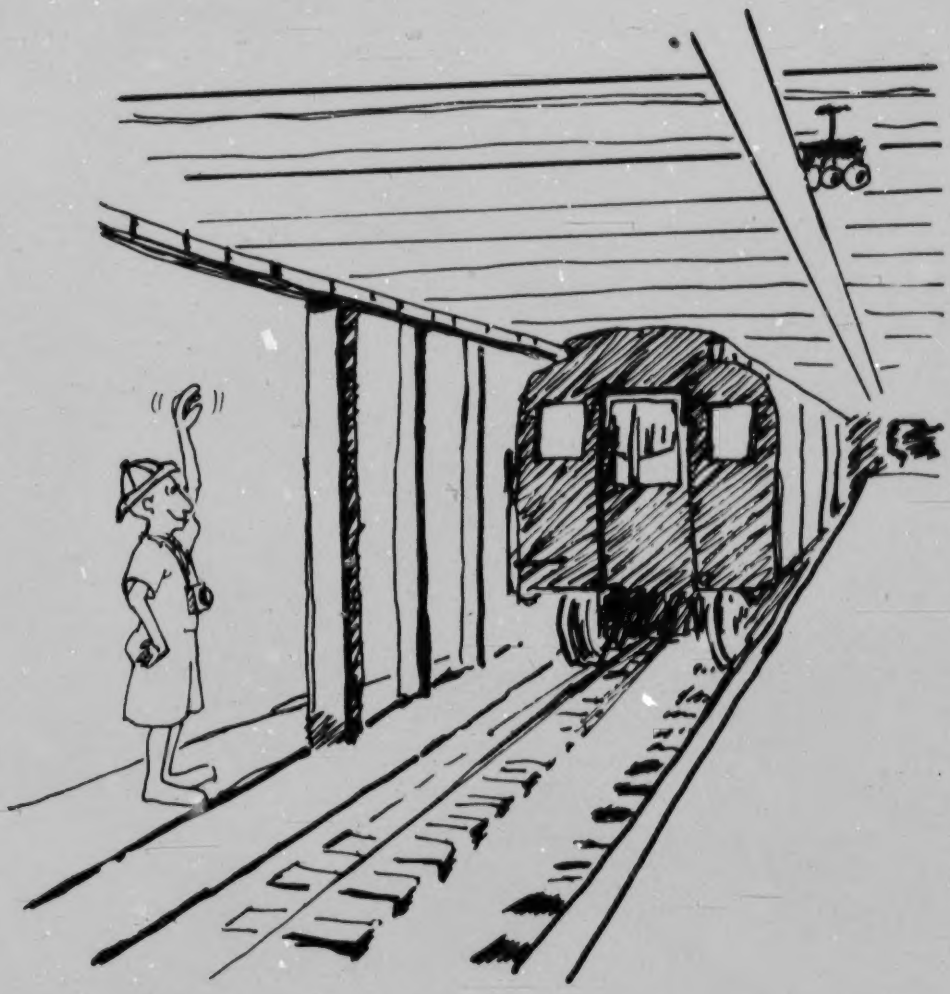
RAILROADS IN 1860

"BOX CARS FOR MOVING DRY GOODS"



"TANK CARS FOR MOVING LIQUIDS"





SUBWAY

TABLE 4.–INDEX OF TRENDS, PRIVATE AND PUBLIC TRANSPORTATION (INDEX 1940 = 100)

Year	Automobile registrations	Transit riders
1940	100.0	100.0
1941	107.9	107.6
1942	101.8	138.3
1943	94.7	170.9
1944	93.0	178.9
1945	93.9	181.1
1946	102.7	182.3
1947	112.2	174.3
1948	121.3	164.9
1949	132.7	145.3
1950	146.8	131.9
1951	155.4	122.7
1952	159.5	114.6
1953	169.0	105.1
1954	176.4	93.9
1955	189.9	87.6
1956	197.3	83.5
1957	203.5	79.5
1958	206.9	74.2
1959	216.7	72.9
1960	224.0	71.4
1961	230.2	68.8
1962	239.8	67.7
1963	250.1	65.7

Wilfred Owen, *The Metropolitan Transportation Problem* (Garden City: Doubleday and Company, Inc.,

TABLE 5.–HOUSEHOLD CAR OWNERSHIP PATTERNS BY AGE, 1969

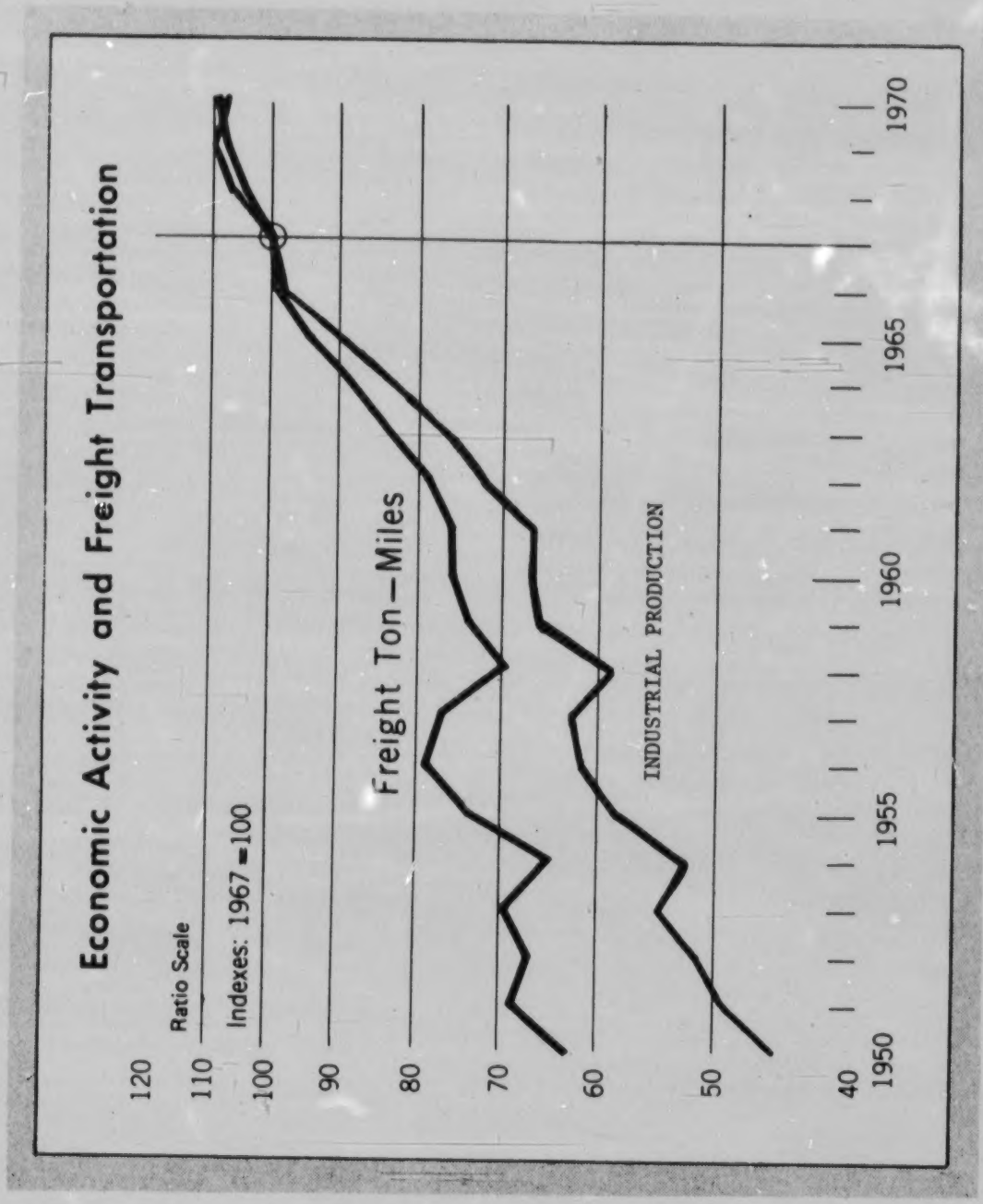
Age of household head	Percent of households owning					Number of cars owned by households
	No car	At least one car	One car	Two cars	Three or more cars	(Millions)
Under 25	18.9%	81.1%	61.2%	18.3%	1.6%	4.6
25-34	12.3	87.7	60.6	25.0	2.1	12.7
35-44	11.7	88.3	48.2	35.0	5.1	16.0
45-54	12.7	87.3	44.0	34.0	9.3	17.1
55-64	20.7	79.3	50.7	24.0	4.6	11.8
65 and over	44.7	55.3	46.4	7.9	1.0	7.6

Source: Automobile Manufacturers Association, *1970 Automobile Facts and Figures* (Detroit: The Association, 1970), p.46.

TABLE 10.—MEAN ANNUAL MILEAGE ON ALL AUTOMOBILES, BY AGE OF FAMILY HEAD, FALL, 1963 AND 1965

Age of family head	Annual mileage
18-24	11,900
25-34	13,400
35-44	14,500
45-54	16,100
55-64	11,300
65-74	5,000
75 or older	2,100

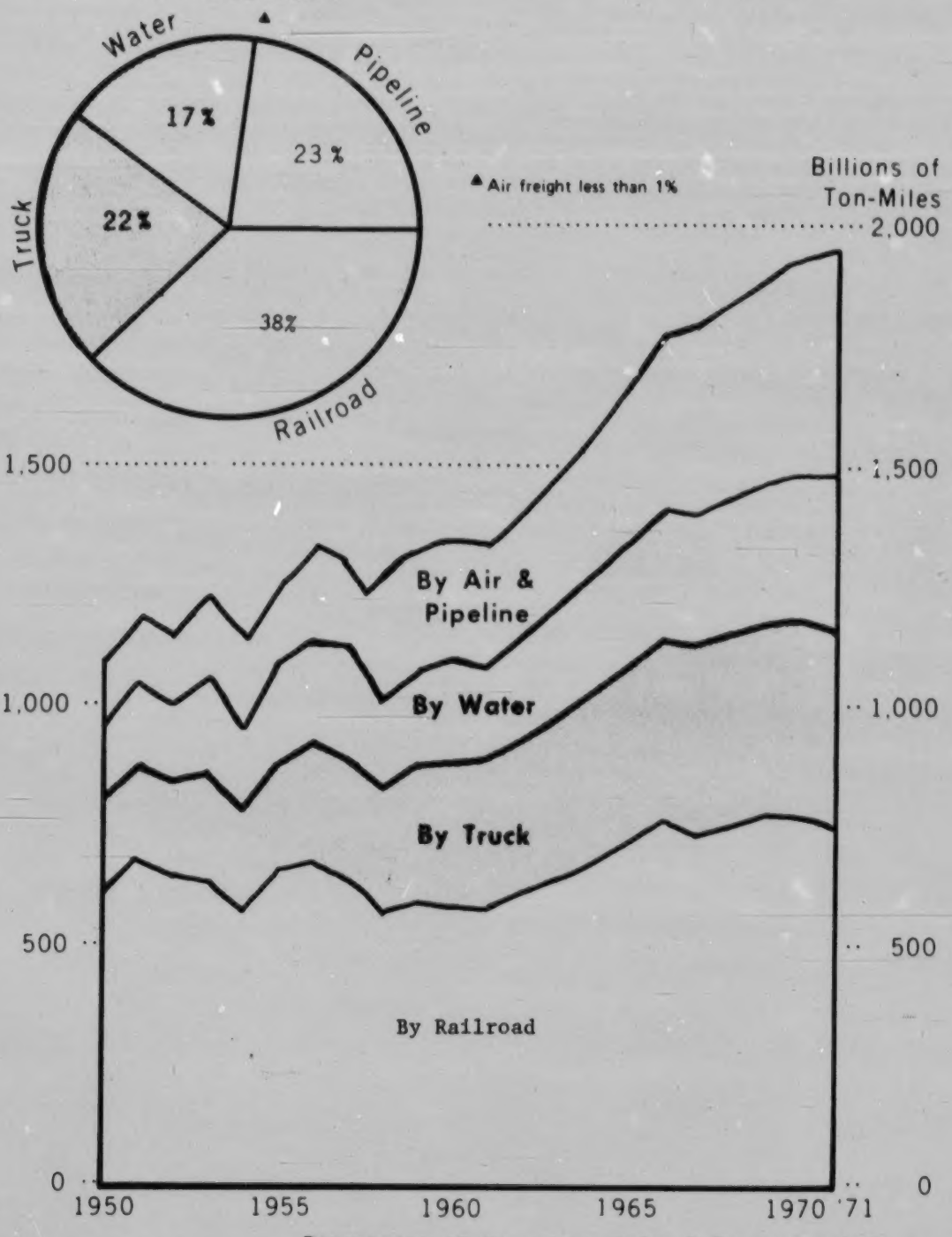
Source: John B. Lansing and Gary Hendricks, *Automobile Ownership and Residential Density* (Ann Arbor: Institute for Social Research, The University of Michigan, 1967), p. 29. Also see pp. 26-30.



CURR. DEVE. CNTR. UK 105-3

Department of Commerce; Federal Reserve Board;
Interstate Commerce Commission; The Conference Board

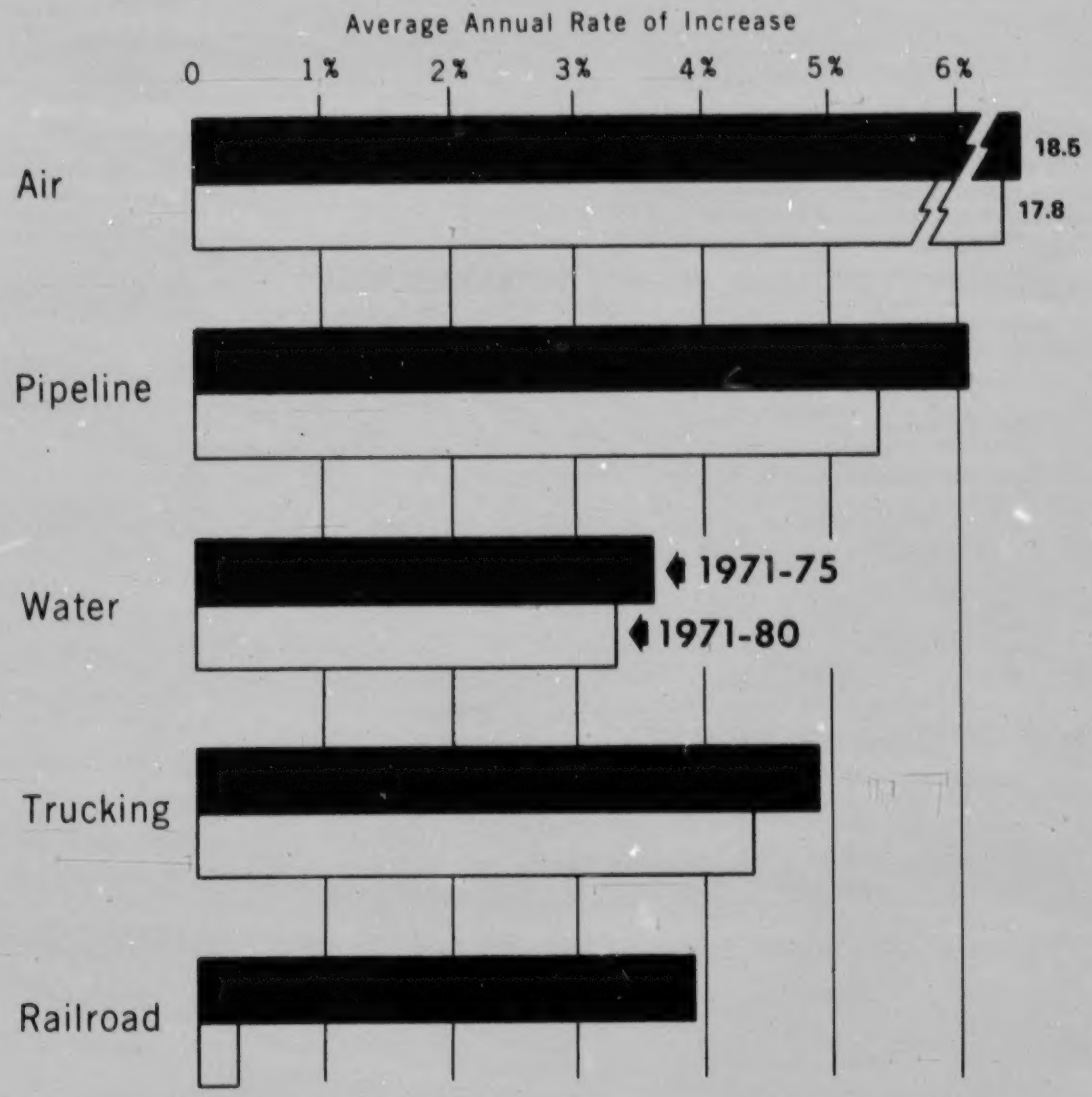
Estimated Freight Transportation Volume



Department of Commerce; Federal Reserve Board; Interstate Commerce Commission; The Conference Board

CURR. DEVE. CNTR. UK 1015-1

Projected Freight Transportation Volume (Ton-Miles)



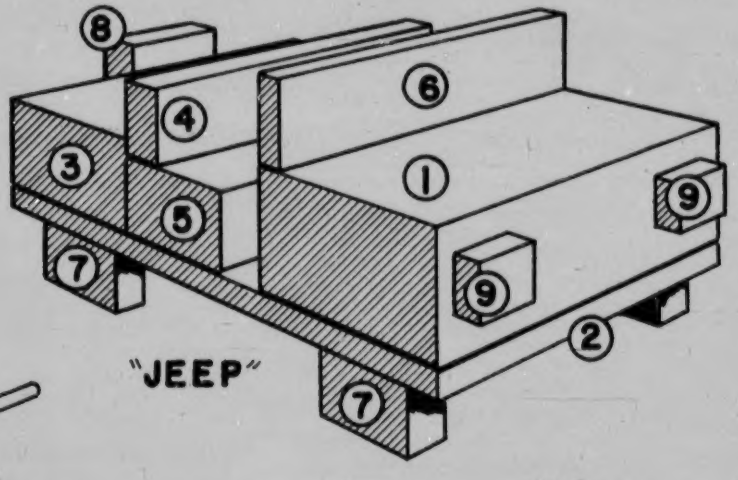
Department of Commerce; Federal Reserve Board; Interstate Commerce Commission; The Conference Board

CURR. DEVE. CNTR. VR. 1015-2

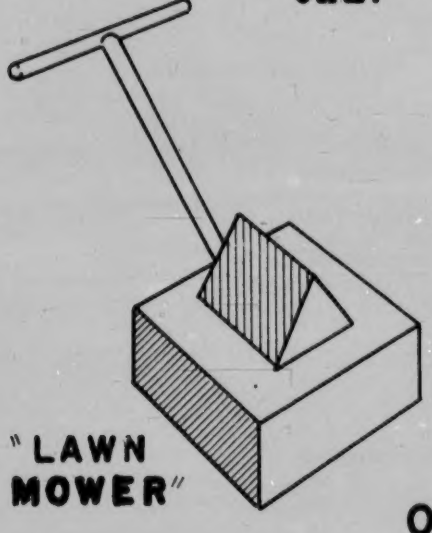
CONSTRUCT A JEEP FROM A SET OF BOXES

BOX SIZES

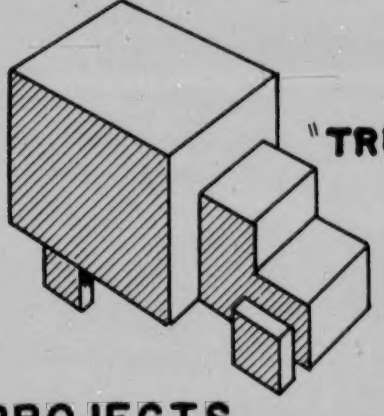
1. 2" x 2" x 1"
2. 2" x 5" x 1/4"
3. 2" x 1 1/4" x 1"
4. 2" x 1/2" x 1"
5. 2" x 1/2" x 1"
6. 2" x 1/4" x 1/2"
7. 1" x 3/4" x 1/2"
8. 1" x 1" x 1/2"
9. 1/2" x 1/2" x 1/4"



"JEEP"



"LAWN MOWER"



"TRUCK"

OTHER PROJECTS

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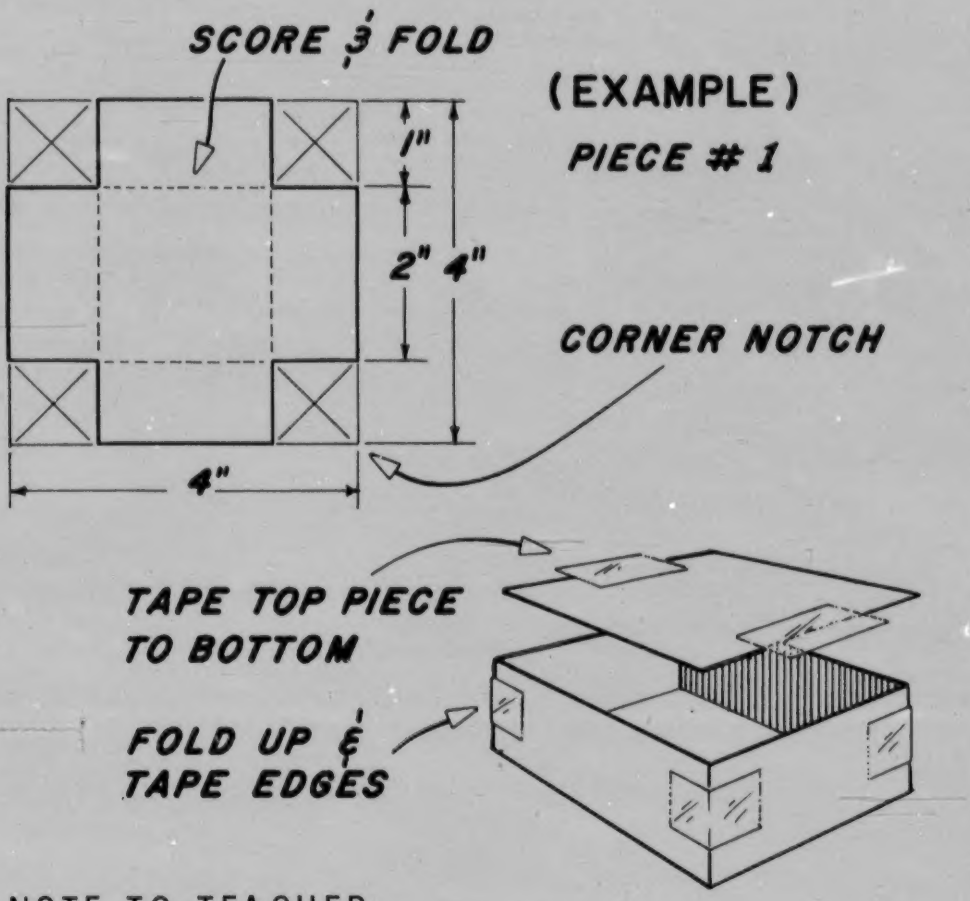
Boxes may be made by taking measurements that include three sides and notching corners. X out all portions to be cut out. Sides to be folded up can be scored with a ball point pen to make folding easier.



NOTE TO TEACHER:
Allow administrator to make calculations for overall sizes of pieces. Top piece for boxes may be cut to actual size.

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UNIT THREE

INTRODUCTION TO THE EXPLORATION

OF

OCCUPATIONS IN WATER TRANSPORTATION

UNIT PURPOSE: To explore, in depth, background information and occupational opportunities in water transportation

PERFORMANCE OBJECTIVES: The student will be able to

I. Identify and discuss the many occupational opportunities in water transportation.

II. Describe the development and functions of water transportation and analyze its importance to the economy.

III. Examine the employment trends and necessary skills outlook in water transportation.

IV. Describe, in depth, at least two water transportation jobs.

I. The student will be able to identify and discuss the many occupational opportunities in water transportation.

A. Suggested Content

1. Careers Relating to Shipbuilding Activities

a. The many occupations represented in most heavy manufacturing industries would also be represented in the ship building industry.

b. Categories of occupations

(1) Design
(2) Management
(3) Construction
(4) Marketing
(5) Accounting
(6) Clerical
(7) Mechanical
(8) Sales
(9) Maintenance
(10) Research
(11) Engineering
(12) Personnel
(13) Labor relations

c. Examples of specific occupations

(1) Metallurgist
(2) Stress analyst
(3) Electronics engineer
(4) Power technician
(5) Petroleum engineer
(6) Riveter
(7) Design draftsman
(8) Metal finisher
(9) Guidance systems engineer
(10) Nuclear physicist
(11) Weldor
(12) Computer specialist
(13) Radar installer
(14) Pipefitter
(15) Communications engineer
(16) Systems analyst
(17) Instrumentation engineer
(18) Pneumatics technician

2. Occupations Relating to Traffic Management

a. Occupational categories necessary to the construction of harbors include most of those represented in other construction work.

(1) Designing, planning, engineering

(2) Analyzing, testing, experimenting
(3) Managing, building, contracting
(4) Accounting, marketing, purchasing

b. Examples of specific occupations in harbor construction, maintenance and operations

(1) Harbor construction

--Designers, engineers
--Secretaries, draftsmen
--Carpenters, ironworkers
--Concrete workers, crane operators
--Dredge operators, weldors
--Electricians, mechanics

(2) Harbor maintenance and operations

--Dredge operators, ship crewmen
--Divers, marine engineers
--Harbormaster, harbor police
--Radar operators, telephone operators
--Tugboat captain, ship crewmen
--Lighthouse keeper, towboat pilot

3. Occupations Relating to Special Equipment and Recreational Boating

a. Examples of recreational and special equipment

(1) Life preservers
(2) Water skis and accessories
(3) Lightweight sailboats
(4) Outboard and inboard motor boats
(5) Trailers and boat hitches

b. Examples of occupations represented by the manufacture and use of recreational boats and special equipment

(1) Designers, assembly workers, draftsmen
(2) Distributors, haulers, salespeople
(3) Repairmen, servicemen, resort personnel

4. Occupations Relating to Mass Transportation

a. A great amount of mass water transportation is due to vacationers and might be considered as organized pleasure boating on a grand scale.

(1) Travel agents
(2) Land or air transportation personnel to point of embarkation

--Bus drivers, railroad engineers, pilots
--Stewardesses, porters, waitresses

(3) Manufacturers and distributors of recreational apparel

--Designers
--Distributors
--Sales people

(4) Ship personnel

--Ship captain
--Steward
--Waiters
--Pilot
--Maids
--Ship hands
--Entertainment personnel
--Dock hands

5. Occupations Relating to Freight Transportation

a. Major occupational categories

(1) Sales

--Opportunities include product and raw materials transfers.

(2) Traffic

--Employees in traffic monitor and effect rates, routes, time and conditions.

(3) Maintenance engineering

--Most large companies maintain full time working crew for making repairs and upkeep. (Welding, scraping, painting, engine service)

(4) Operations

--Working operations include captain, stewards, and ship hands.
--Terminal operations require dock workers, freight handlers, checkers, dispatchers, managers, service personnel and supervisors.

B. Suggested Teaching-Learning Activities

1. Write to travel agencies for brochures of vacation cruises. Students should use the photographs and information to identify transportation jobs.

2. Arrange a tour of or write to a barge line for information and literature on the operation of, services offered, and maintenance required for the operations.

3. Have each student choose an occupation from one of the areas covered and prepare a class report.

4. Students should interview adults who own pleasure boats and compile a list of all the services and occupations required for the total use and maintenance of the craft.

C. Suggested Evaluation

1. Each student will select two occupations of his choice related to this lesson and outline all of the duties required in the performance of those jobs.

D. Suggested Resources

1. Books

   a. Materials Handling - Traffic and Transportation

   b. Occupations and Careers

   c. Occupational Outlook Handbook

2. Booklets

   a. "Guide to Federal Career Literature"

3. Films

   a. "Boating Fever"

   b. "Boats Need People"

   c. "Clearwater - Sports"

   d. "Inclination Towards Water"

II. The student will be able to describe the development and the various functions of water transportation and analyze its importance to the economy.

A. Suggested Content

a. The worlds most prosperous cities have developed on protected shorelines and navigable rivers.

(1) Man has long recognized that moving goods by water is the most economical method.
(2) Improved navigational technology and sturdier ships launched mankind into world wide exploration in the 15th and 16th centuries.
(3) Early ships were constructed of wood; however, some societies made vessels from lashed reeds, papyrus, branches and stretched animal skins.

The following chronological listing relates man's progress in water transportation.

(1) 6000 BC - The first vessels were floating logs. Men learned to tie several together to form rafts.
(2) 5000 BC - The word "ship" (Latin), means "to scoop." Dugout logs were used as crude vessels.
(3) 4000 BC - The Egyptians covered rafts with skins; this resulted in improved floatation.
(4) 3000 BC - The Egyptians built the first seagoing vessels powered by crude sails and manned oars.
(5) 2000 BC - Cretan fighting galleys and merchant ships dominated the Mediterranean.
(6) 1200 BC - The Phoenicians dominated world trade with merchant fleets for 500 years.
(7) 500 BC - Greek warships, carrying 170 oarsmen, could travel seven mph.
(8) 200 BC - Roman and Carthaginian navies dominated the seaways.
(9) 800 - Viking longboats were clinker-built of oak planks. They could carry a crew of 240 men.
(10) 1100 - The magnetic compass credited to the Chinese enabled ships to sail out of sight of land.
(11) 1250 - British navies employed weapons capable of striking enemy vessels.
(12) 1450-1522 - World wide exploration fetes were accomplished by Diaz, Columbus, DaGama, Magellan.
(13) 1577 - Sir Francis Drake became the first Englishman to sail around the world.
(14) 1620 - The Mayflower carried the pilgrims to America.
(15) 1731 - Newton's sextant, invested before 1700, was first used for navigating.
(16) 1783 - A steam-operated paddleboat was invented in France.
(17) 1790 - John Fitch built a passenger steamboat which operated on the Delaware River.

(18) 1800 - Robert Fulton built and launched the Nautilus, a 21 foot submarine.
(19) 1807 - Robert Fulton's steamer Clermont was put into service on the Hudson River.
(20) 1816 - Packer ships began regular service between New York and Liverpool.
(21) 1817 - The Erie Canal, marking the beginning of long distance canal construction, was built. It connected the Hudson River with the Great Lakes.
(22) 1819 - The American Steamship, Savannah, was the first to cross the Atlantic.
(23) 1836 - The screw propeller was invented by Francis Smith, an Englishman.
(24) 1869 - The Suez Canal opened providing a short trade route to the East.
(25) 1894 - The steam turbine was first used to power ships.
(26) 1907 - Transatlantic travel time was reduced to five days by large liners under turbine power.
(27) 1911 - The liner, Titanic, sank after striking an iceburg in mid-Atlantic.
(28) 1938 - The liner Queen Mary, carrying 2,000 passengers, could cross the Atlantic in less than four days.
(29) 1940 - 1945 - World War II produced large well-equipped modern navies and created enormous advances in marine technology.
(30) 1958 - The United States launched the world's first submarine which could run for two years on a single fueling.
(31) 1959 - The St. Lawrence Seaway opened giving ocean vessels access to the Great lakes.
(32) 1962 - The USS Savannah, the first nuclear-powered merchant ship, was put into service.
(33) 1969 - Automated super-ships over 1000 feet long carry petroleum and cargo over the worlds seaways.

2. Designing Ships

a. Basic designs of surface vessels have remained rather stable. By contrast, air and land vehicles have undergone frequent radical changes.

(1) Overcoming resistance created by friction between the vessel and the water has been the ship designer's greatest problem.

b. Power systems have changed over the centuries; however, the steam turbine predominates as the system used in large vessels.

NOTE: Refer to lesson "The History of The Automobile" for a review of inventions improving power systems of vessels.

c. Examples of power systems for large vessels

(1) Coal-fired reciprocating steam engines
(2) Coal-fired steam turbines
(3) Atomic-powered steam turbines
(4) Oil-fired steam engines
(5) Diesel engines
(6) Diesel-electric units
(7) Gasoline piston engines

--Some small size military vessels and fishing fleets use gasoline engines.

(8) Electric motors (battery powered)

--Submarines are equipped with storage battery systems.

d. Examples of power systems for medium and small vessels

(1) Diesel engines
(2) Piston-type inboard gasoline engines
(3) Rotary-type inboard gasoline engines
(4) Rotary-type and piston-type inboard/outboard engines
(5) Electric outboard motors
(6) Gasoline outboard engines
(7) Aircraft engines for propellor drives
(8) Water-jet engines

3. Building Ships and Boats

a. Once a handmade production and assembly process, modern shipyards have become automated using assembly lines and conveyors.

(1) Automatic cutting torches, programmed to design specifications by computer, produce hull and deck parts quickly. Some shipyards turn out cargo vessels and tankers at the rate of ten or more annually.

b. Materials for building hulls and decks

(1) Wood, copper and brass were once the principal materials used.
(2) Steel hulls and decks have been used for building large vessels for many years.
(3) Aluminum, fiberglass and many types of durable plastics are used in modern ship and boat structures.

4. Harbor and Dock Construction

a. Building harbors in the past involved limited planning and design.

b. Modern harbor construction begins in research laboratories.

(1) Scale models of coastlines and harbors are constructed in large artificial pools.
(2) The effects of wind, water, erosion and structural stresses can be simulated on model docks, piers, jetties and breakwaters.
(3) Simulation studies have led to many technical improvements in harbor design.

c. Natural harbors with narrow entrances offer land mass for protection from wind and water.

(1) Smooth shorelines that are exposed to open seas require dredging and breakwaters.

d. Terminology and definitions related to harbor and dock facilities and functions

(1) Harbor - a sheltered body of water for anchoring or mooring ships
(2) Quay - (Wharf) a platform built along a shoreline
(3) Pier - a platform extending out into the water
(4) Dock - the space between piers
(5) Breakwater - stone, concrete or steel barriers erected to protect a shoreline
(6) Buoys - floating signal devices for marking safe water routes and locating hazards
(7) Marina - a special docking area usually for pleasure boats and yachts with services and facilities

5. Present-Day Water Transportation Activities

a. Merchants fleets of the world according to the number of ships and deadweight tonnage

(1) As of December 1971:

Country	No. Ships	Deadweight Tons
Liberia	2,011	71,156,000
Japan	2,153	44,900,000
United Kingdom	1,713	40,673,000
Norway	1,199	36,196,000
Greece	1,386	21,340,000
United States	1,372	19,634,000
Russia	2,059	14,957,000
West Germany	958	12,545,000
France	450	10,999,000
Italy	630	10,696,000
Panama	727	9,838,000
Sweden	359	7,594,000

(2) Types and number of vessels classified under merchant ships categories from all countries

Type of Vessel	Number
Freighters	11,095
Tankers	4,431
Bulk Carriers	3,218
Refrigerated Freighters	918
Combination Cargo/Passenger	847
Combination Cargo/Passenger (Refrigerated)	95
TOTAL	20,544

b. Passenger ships

(1) During the 1930's, passenger service by ocean vessel reached its peak.
(2) The efficiency of air travel during the late 1940's proved a disaster to world ocean liners.

--Britain sold the Queen Mary and Queen Elizabeth to American investors as tourist attractions in the 1960's.
--The USS United States, the fastest ocean liner ever, was retired in 1969 because of a lack of passengers. The U.S. has no major transatlantic passenger service.

(3) France, Britain and Italy offer transatlantic passenger service, however sailings are not scheduled on a year-around, regular basis.
(4) Short distance passenger vessels have increased in importance rapidly.

--Ferries
--Hydrofoils
--Air-cushion vehicles

c. Lake and river tansportation

(1) The Great Lakes opened up to ocean shipping with the building of the St. Lawrence Seaway.

--Twenty thousand workers finished the St. Lawrence Seaway in less than five years.
--More than 50 million tons of traffic use the seaway annually.
--In addition to the Great Lakes, ferry, freight and passenger services are operated on large and small lakes throughout the United States.

(2) River traffic in the United States has flourished during these centuries.

--The Missouri, Mississippi, Ohio, Hudson and Tennessee rivers carry thousands of tons of freight.
--Some powerful tugboats can push up to 40,000 tons of loaded barges. This would equal eight 100-car freight trains.
--Lumber, grain, petroleum, livestock, vegetables, coal, oars, chemicals, machinery, ammunitions, structural parts and automobiles are among the many types of freight transported by river barge.
--During Would War II, military vessels were built in Midwest factories and floated downstream to New Orleans for ocean launching.
--Regular psssenger service on many rivers is available for crossing and up and downstream between cities.

d. Pleasure boating

(1) Pleasure boating in the United States began in the early 1800's. The New York City Yacht Club was founded in 1844.
(2) The number of pleasure boats used in the U.S. and Canada increased from 1 1/2 million in 1945 to 9 million in 1970. Correspondingly, the number of pleasure boaters rose from 5 million to more than 44 million persons.
(3) The horsepower average of outboard motors in 1940 was 3 hp. By 1970 this average had increased to 33 hp.
(4) Types and sizes of pleasure boats.

--Sailboats (Range from 10 feet to 100 feet)

-Sloop - two sails, one mast
-Catboat - one sail, one mast
-Yacht - three or more sails, two masts
-Ketche, schooner, yawl - large yacht

--Rowboats

-Jon-boat (skiff or dory) flat bottom, usually to 14 feet in length
-Canoe - average size of 17 feet, but some as large as 30 feet are used

--Motorboats

-Runabout - 14 to 16 feet in length
-Crusiers - 20 to 48 feet in length
-Motor yachts - 50 to 100 and more feet in length
-Motor sailers - motor yacht with masts and sails

B. Suggested Teaching-Learning Activities

1. Construct a diorama of a model harbor. Teams of two to three students each could select a section for development. Any or all of the following ideas could be incorporated. Careful committee planning and a scale drawing should precede construction. (Save for later lesson.) See "Diorama of a Model Harbor," p. 140.

   a. Base - A 2' x 6' piece of insulation board would be suitable. To simulate waves and/or rough water beyond the breakwater area, glue on strips and fragments of string and fine gravel particles. Spray on hues of blues, greens and grays to achieve realistic water shades. Allow paint to build up around string and gravel particles in order for them to blend gradually.

   b. Breakwater - Before the paint base dries thoroughly, set a first course fo small flat stones or marble chips in place.

   c. Shoreline - An irregular shoreline can be constructed from papiermache, styrofoam scraps and small bits and chips or stone. Beaches may be simulated by sprinkling sand on areas where glue has been spread. Colors may be added with tempra powder paints or spray paints.

   d. Wharf - A shoreline wharf may be constructed using styrofoam or wood strips. A one to one and one-half inch rise above the water surface will maintain a reasonably appropriate scale.

   e. Piers - Piers can be constructed from small strips of wood or styrofoam. Storage piers and grain elevators should rise two to three and one-half inches above the water surface. Wharfs and piers can be spray painted or tempra painted with grays and silver tones to appear realistic.

   f. Facilities - Small models of cranes, conveyors, bins, hoppers and wharf buildings should be added as finishing touches. Small pieces of tubing and discarded wheels can be used to simulate lines and valves for petroleum tanker loading piers. Buoys should be located to mark harbor channels. Small boat and ship models can be constructed from paper, wood and plastic to be appropriately placed on the diorama.

2. Start a collection of prints or pictures of famous sailing vessels.

3. Construct a time line chart depicting significant events in water navigational history.

4. Prepare a glossary of terms relating to water transportation.

5. Write, prepare and present a short skit portraying an event from navigational history. Such a drama might represent the opening of the Erie Canal, the launching of a sailing vessel, the invention of the steamboat or news of the first globe circling voyage.

6. Have students select a maritime organization and write letters requesting information regarding careers in shipping and boating.

7. Correspond with the U.S. Department of Commerce, U.S. Department of Transportation to secure current information about merchant shipping activities.

8. Prepare a chart or bulletin board display listing the many categories of business, operational, maintenance, distributive, protective, administrative, governmental and retail activities that result from water transportation.

9. Construct a display of model ships and boats. See "Canoe," p. 141, "Outrigger," p. 142, "Viking Ships," p. 143, "Mayflower," p. 144, "Clermont Steamboat," p. 145, "Riverboat," p. 146, "Cargo Vessel," p. 147, "Inland Water Carriers," p. 148, "Ocean Liners," p. 149, "Petroleum Tankers," p. 150, and "Catamaran," p. 151.

10. Discuss with students the concept of "the romance of the sea" as depicted in many outstanding novels. Students should express their reactions to the weather conditions that might be experienced at sea. How did they feel after seeing a motion picture film that depicts a storm at sea? Are any of the students given to motion sickness?

11. Ask a member of a boat club or the Coast Guard to speak to the class about boating safety.

12. Have each student list ten inventions related to water transportation and rank them according to importance.

13. Involve the student in a discussion of how the water transportation vehicle influenced the change in the world economy.

14. Have each student write a report on the St. Lawrence Seaway.

15. Have each student write a report about traffic on the Mississippi River Inland Waterways System.

16. Correspond with maritime agencies and associations to acquire published information, photographs, films, pictures and other documents relating to shipbuilding.

17. Assign small teams of students to build models of old and modern boats and ships. Many kits are available utilizing preformed plastic parts at reasonable cost.

C. Suggested Evaluation

1. Students should present a written or oral review examination to include the following topics:

   a. Major merchant fleets of the world

   b. Types of vessels involved in shipping

   c. Passenger travel by water

   d. Inland shipping activities

   e. Pleasure boating activities

   f. Occupations in the water transportation industry

D. Suggested Resources

1. Addresses of Agencies and Associations

   a. See appendix, p. 239

2. Books

   a. Airplanes and Trucks and Trains, Fire Engines, Boats and Ships and Buildings and Wrecking Machines

   b. Glory of the Seas

   c. Materials Handling-Traffic and Transportation

   d. A Statistical Analysis of the Worlds Merchant Fleets

   e. Technology-Creative Man Library/Vol. I

   f. The World Book Encyclopedia, Vols. 2,7,9, 17, 19

3. Booklets

   a. "Going Places in Oil"

   b. "Guide to Federal Career Literature"

   c. "Inland Now"

   d. "Marine Guide for Finishing of Aluminum Hulls"

e. "Merchants Fleets of the World"

f. "Seafaring Guide..and Directory of Labor-Management Affiliations"

g. "United States Department of Transportation-Facts and Functions"

4. Films

a. "Men, Ships, and Great Lakes," U.S. Army Engineers District

b. "The Wonder of Water," Association-Sterling Films

5. Pamphlets

a. "Proof! That the Boating Man's Boat is Aluminum"

b. "Questions and Answers About Aluminum Boats"

6. Resource Persons

a. Boat club member

b. Coast Guard man

7. Transparency Masters

a. "Diorama of a Model Harbor," p. 140

b. "Canoe," p. 141

c. "Outrigger," p. 142

d. "Viking Ships," p. 143

e. "Mayflower," p. 144

f. "Clermont Steamboat," p. 145

g. "River Boat," p. 146

h. "Cargo Vessel," p.147

i. "Inland Water Carriers," p. 148

j. "Ocean Liner," p. 149

k. "Petroleum Tanker," p. 150

l. "Catamaran," p. 151

III. The student will be able to examine the employment trends and necessary skills outlook in water transportation.

A. Suggested Content

1. There has been a long term decline in the number of men and vessels in our merchant marine.

   a. The exception has been during periods of war and national emergency.

   b. The trend is expected to continue through the 1970's.

   c. Some job openings will arise each year to replace men who retire or quit.

   d. New ships are being built, but not at as rapid a rate as those being retired.

      (1) Future ships will be improved and more automated.

      --Conventional ships require 55 men.
      --Improved, newer ships require 42 men.

2. Inland water transportation of freight continues to be on the increase.

   a. The barge line continues to be an efficient means of hauling large supplies of raw and refined materials.

      (1) Coal
      (2) Sand
      (3) Gas
      (4) Sugar

   b. Water transportation accounts for 17% of the total freight transportation volume.

      (1) Freight ton miles almost doubled from 1950 to 1970.

   c. The projected annual rate of increase of water transportation freight volume is 3 1/2% until 1980.

3. Recreational boating has been on the constant increase.

   a. The energy crisis could affect it adversely.

   b. A shorter work week and more leisure time could exert a positive influence.

4. New major inventions that improve the efficiency of water transportation could affect the industry.

   a. Ships of the future:

(1) Air cushion vehicles ACV have greatly increased the speed for waterborne vessels. Described as hovercraft, they are actually airborne at high speed, utilizing the water surface as a resistance platform.

(2) Hydrofoil designs, allowing vessels to plane higher in the water, allow increased speed.

(3) Great new super-tankers carry petroleum products, liquified gases and chemicals.

(4) Fishing vessels, equipped to completely process catches from net to can or frozen package, can function for several years without docking. Crew rotation, refueling and service vessels make this possible.

NOTE: The following questions have been included to help the student gain some insight into investigative diagnosis of trends and outlooks. Both the teacher and students may expand upon this list by providing applicable questions of their own.

5. Where is the nearest water transportation industry and what is the nature of the business?

6. If relocation is necessary to reach a water transportation industry, which locale and work atmosphere is most desirable?

7. Define the amount of job security.

   a. Is this a factor?

8. Will there be new jobs created through retirement?

9. What skills are required?

   a. Future skills development

10. What educational background is required?

    a. Chances for advancement

11. How may automation and new technology affect the industry?

    a. Positively

    b. Negatively

12. Will population growth pattern be a factor?

B. Suggested Teaching-Learning Activities

1. Select a career such as ship's captain, pilot, yeoman, boatsman, etc. Outline the duties of the selected occupation, and describe how those duties have changed as water transportation has evolved.

2. Involve the students in a discussion of how they believe water transportation of freight will operate in the future.

3. Determine which industries in the area are involved with any form of water transportation. Contact these industries to determine from them the net change in personnel numbers in the last ten years and in which areas these changes were made.

4. Determine what, if any, new construction is planned that would affect water transportation in the area. (Dams, canals, expanded waterways.)

5. Plan a display of pictures depicting the evolution of boat construction and design. Have the students individually or in groups design their own future projections to add to the display.

6. Have a representative from the merchant marine, coast guard, or recreational boat dealership discuss with the students the employment outlook in the state.

C. Suggested Evaluation

1. Have the students discuss several kinds of water transportation jobs that will be in demand in the 1970's and 1980's. Base the evaluation on the information gathered concerning the employment outlook.

D. Suggested Resources

1. Addresses of Agencies and Associations

   a. See appendix, p. 239

2. Books

   a. Occupational Outlook Handbook

3. Booklets

   a. "Guide to Federal Career Literature"

   b. "United States Department of Transportation Facts and Functions"

4. Resource Persons

   a. Coast guard representative

   b. Merchant marine

   c. Recreational boat dealer

IV. The student will be able to describe, in depth, at least two water transportation jobs.

A. Suggested Content

1. Able Seaman

a. Earnings (1973)

(1) $499 per month - base pay

b. Job characteristics and duties

(1) Have thorough knowledge of all ship parts, gear, and equipment
(2) Act as helmsmen or quartermaster to steer the ship

--2-hour turns at the wheel
--Serve as lookouts for watch officer

(3) Responsible for rigging, overhauling, and handle stowing cargo and other gear
(4) Tie common knots and handle mooring lines
(5) Must be familiar with fire prevention and control and participate in periodic fire drills
(6) Performs duties of ordinary seaman

--Scrub decks
--Coil and splice ropes
--Chip rust
--General maintenance

c. Educational requirements and other qualifications

(1) No minimum educational requirements
(2) Must be 19 years of age
(3) Must have served one year as an ordinary seaman
(4) Must pass coast guard exam in seamanship

d. Advancement possibilities

(1) May advance through the ranks in the following order although advancement beyond one step is unlikely

--Boatswain or bosun
--Third mate
--Second mate
--Chief mate
--Master or captain

(2) Must pass increasingly difficult Coast Guard exams

--Though no formal training is required, it is usually needed to pass the exams.

--Training programs and schools are available.
--Competition for entrance to the training academies is very keen

2. Captain or Master of the Ship

a. Earnings

(1) $2,305 per month - base pay

b. Job characteristics or duties

(1) In charge of total ship and all departments and personnel

--Radio operator
--Deck department

-Chief mate
-Second mate
-Third mate
-Boatswain
-Utility man, able bodied seamen, ordinary seaman

--Engine Department

-Chief engineer
-1st assistant
-2nd assistant
-3rd assistant
-Electrician, engine utility men, oilers, firemen water tenders, wipers

--Stewards department

-Chief steward
-Chief cook
-2nd cook and baker
-Messman and utility men

(2) Has complete authority and responsibility for the operation of the ship

--Discipline and order
--Safety of crew, passengers, cargo, and vessel

(3) May act as ship owner's agent
(4) May serve as paymaster

c. Educational requirements and other qualifications

(1) Equivalent of a B.S. degree
(2) Service requirements

(3) Licensing through exams

d. Advancement possibilities

(1) There are none on the ship. This is the top position.

3. Boating Law Enforcement Officer

a. Earnings

(1) Base pay annually - $7,716
(2) Longevity rate - $10,872

b. Job characteristics or duties

(1) Has immediate charge of all law enforcement duties with reference to the Water Enforcement Division
(2) Patrols assigned area in patrol boat

--Inspects motor boats for registration and safety equipment
--Checks to see if dealers and manufacturers are properly licensed
--Investigates water accidents
--Promotes water safety programs
--Participates in rescue, search and recovery operations
--Makes arrests and prepares records

(3) Teaches classes and shows films on boating safety

c. Educational requirements

(1) Must pass swimming test administered by Department of Transportation
(2) Knowledge of rules, regulations and laws affecting water safety
(3) Skill in operating a motor boat
(4) Ability to speak to the general public and present talks on safety

B. Suggested Teaching-Learning Activities

1. The teacher will attempt to arrange a field trip which will let all of the students experience a boat ride.

2. Students will each be assigned one sailor's knot, learn how to tie it, and then teach it to the rest of the class.

3. Students will compile a list of nautical terminology

4. Students will bring or make models of boats or ships to fit the scale of the diorama from a prior lesson. With one student serving as captain and another serving as crew, the captain will direct the sailing of the ship around the harbor and in docking procedure by using correct nautical jargon. See "Diorama of a Model Harbor," p. 140.

5. Take the students on a field trip to the nearest swimming pool.

C. Suggested Evaluation

1. Have each student select an occupation of his choice related to this lesson for which he will prepare an information outline containing employment outlook, approximate wages, training requirements, route of employment entry, union affiliations and advancement possibilities.

D. Suggested Resources

1. Books

a. Occupations and Careers

b. Occupational Outlook Handbook

c. Department of Transportation

2. Films

a. "Bridging the Seas"

b. "Legal Requirements for Boatmen"

c. "Long Ships Passing"

d. "Merchant Marine Safety"

e. "The Port of Mobile"

3. Transparency Master

a. "Diorama of a Model Harbor," p.140

SUPPORTIVE MATERIALS

FOR

UNIT THREE

REFERENCE LIST FOR UNIT THREE

BOOKS

1. Airplanes and Trucks and Trains - Fire Engines, Boats and Ships and Building and Wrecking Machines by Geroge Zaffo, Grosset & Dunlap, Publishers, 1972

2. Department of Transportation - Class - Title - Description Superintendent of Documents, United States Government Printing Office

3. Glory of the Seas by Michael J. Mjeld, Wesleyan University Press, 1970.

4. Materials Handling - Traffic and Transportation Elias S. Tyler and Eugene J. Corenthal, McGraw-Hill Book Company, 1970

5. A Statistical Analysis of the World's Merchant Fleets U.S. Department of Commerce, U.S. Government Printing Office, 1970

6. Technology - Creative Man Library/Vol I. Charles E. Merrill Publishing Company, 1968

7. The World Book Encyclopedia, Vols. 2, 7, 9, 17, 19 Field Enterprises Educational Corporation, 1972

BOOKLETS

1. "Guide to Federal Career Literature," United States Civil Service Commission, U.S. Government Printing Office, 1972

2. "Going Places In Oil," American Petroleum Institute

3. "Inland Now," Inland Steel

4. "Marine Guide for Finishing of Aluminum Hulls," Reynolds Metals Company

5. "Merchant Fleets of the World," U.S. Department of Commerce, Maritime Administration

6. "Seafaring Guide...and Directory of Labor-Management Affiliation," U.S. Department of Commerce, Maritime Administration

7. "United States Department of Transportation - Facts and Functions," U.S. Government Printing Office, 1971

FILMS

1. "Bridging the Seas," 16mm, Association-Sterling Films, 1966
2. "Boating Fever," 16mm, Eastman Kodak Company, 1970
3. "Boats Need People," 16mm, National Association of Engine and Boat Manufacturers Film Library, 1969
4. "Clearwater Sports," 16mm, Florida Department of Commerce
5. "Inclination Towards Water," 16mm, Belgian Embassy, 1965
6. "Legal Requirements for Boatmen," 16mm, United States Coast Guard, 1968
7. "Long Ships Passing," 16mm, Lake Carriers Association, 1967
8. "Men, Ships, and Great Lakes," 16mm, U.S. Army Engineers District, 1960
9. "Merchant Marine Safety," 16mm, United States Coast Guard, 1962
10. "The Port of Mobile," 16mm, Alabama State Docks, 1970
11. "The Wonder of Water," 16mm, Association-Sterling Films, 1967

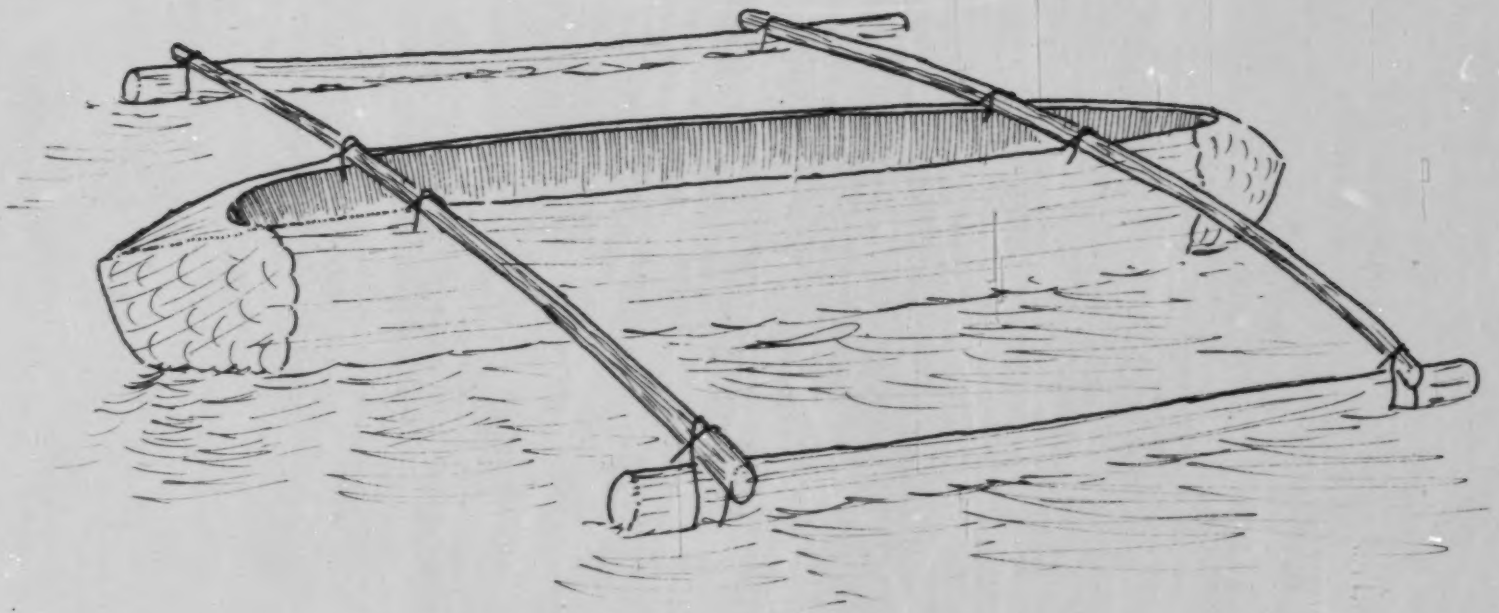
PAMPHLETS

1. "Proof! that the boating man's boat is Aluminum," Reynolds Metals Company
2. "Questions and Answers About Aluminum Boats," Reynolds Metals Company

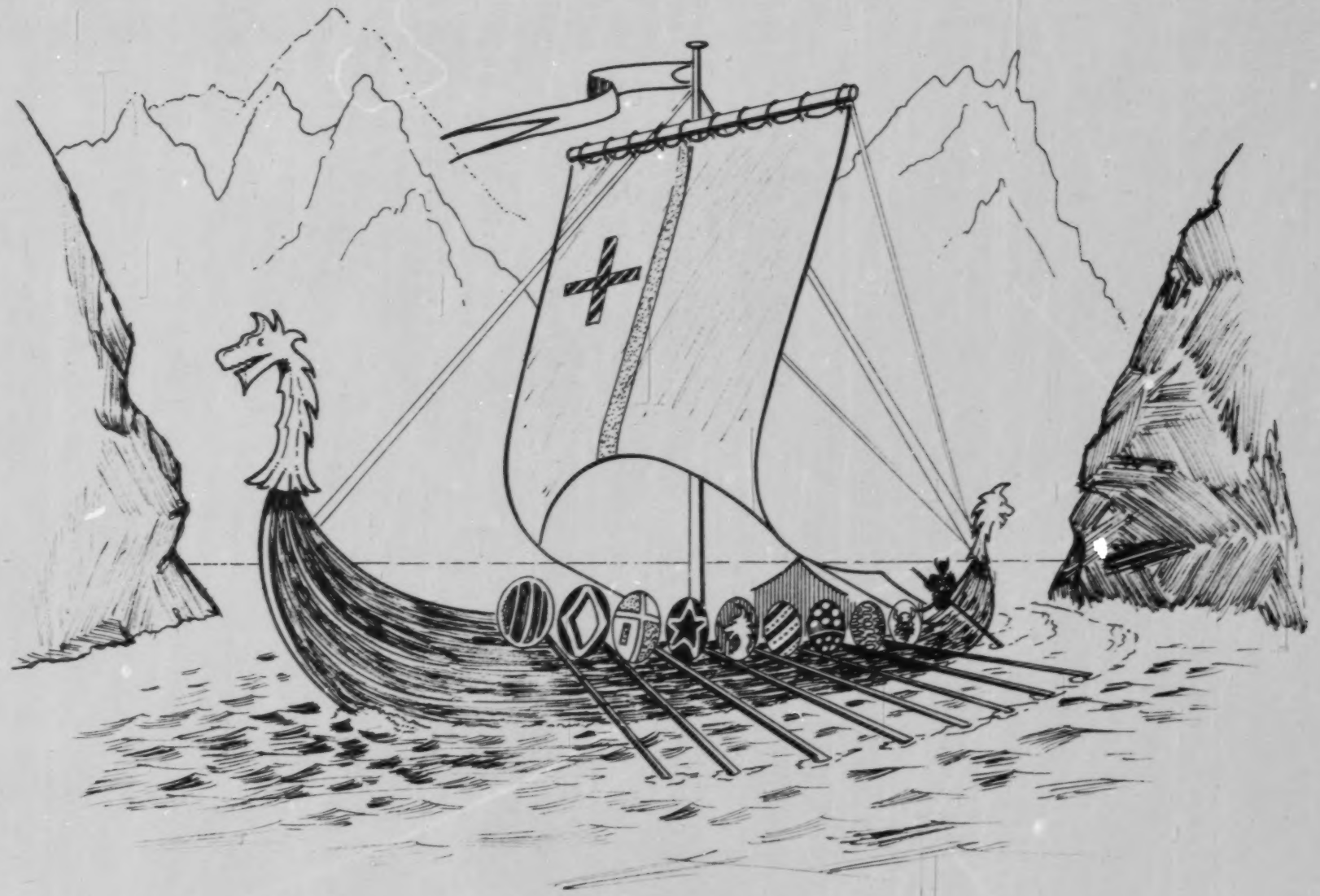
R. GILMORE CURR. DEVE. CNTR. UK 1031-2

R. GILMORE CURR. DEVE CNTR. UK. 993-8

T. GILMORE, CURR. DEVE. CNTR. UNK. 993-11

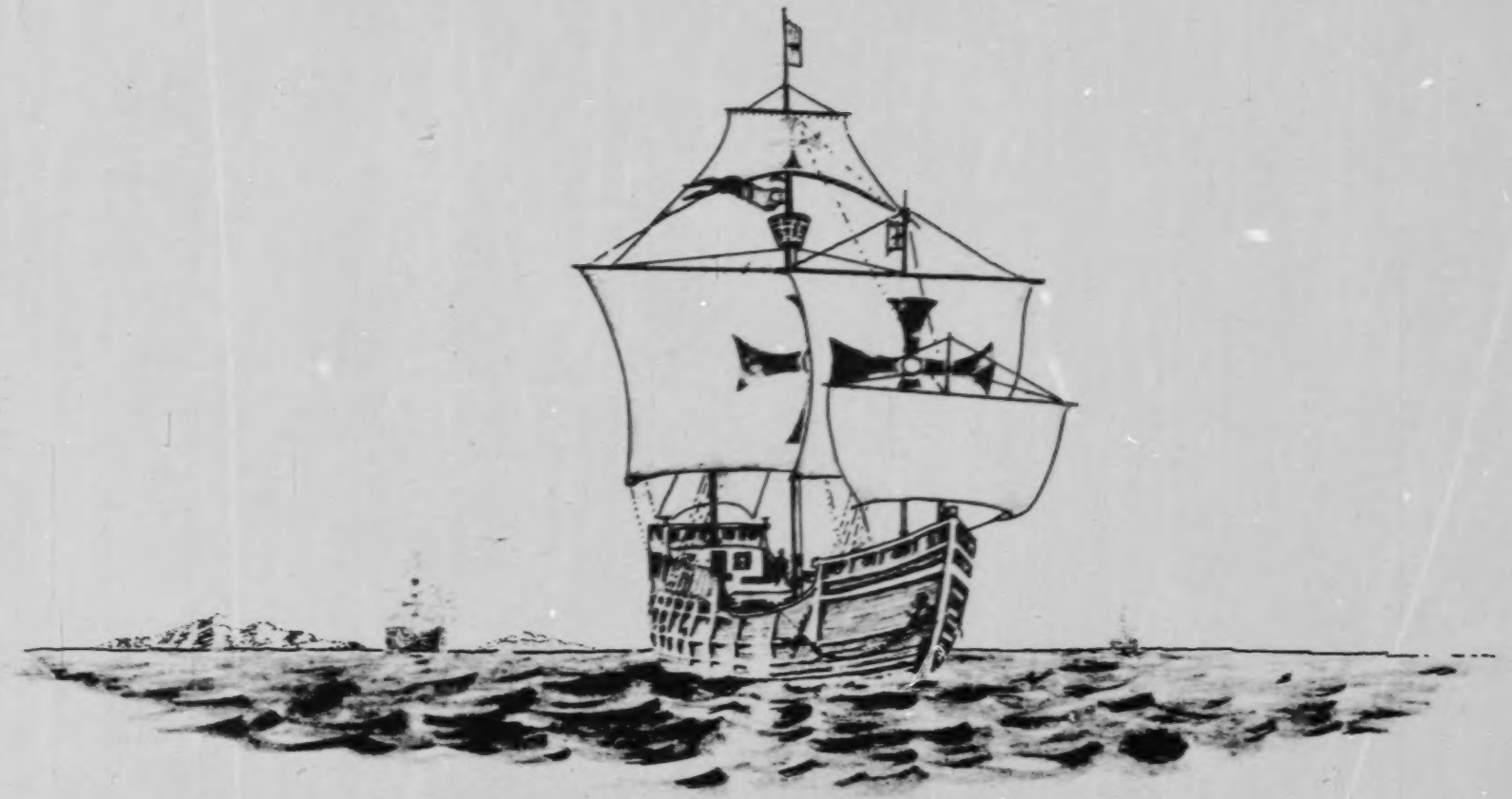


OUTRIGGER



VIKING SHIPS

P GLACIER CORP REF CNTR 993-12



MAYFLOWER

CLERMONT STEAMBOAT

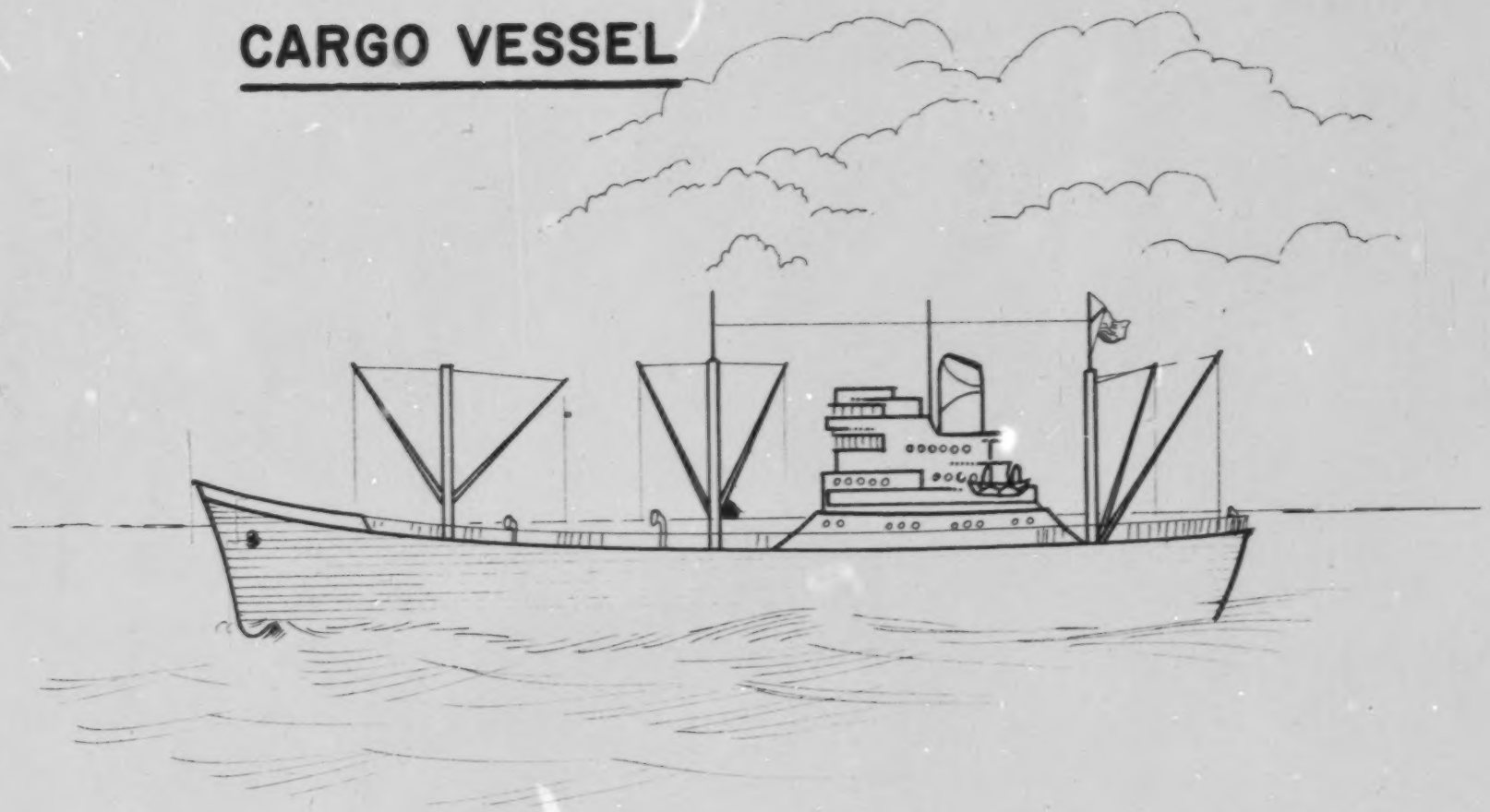
R. GILMORE. CURR. DEVE. CNTR. U.K. 993-14

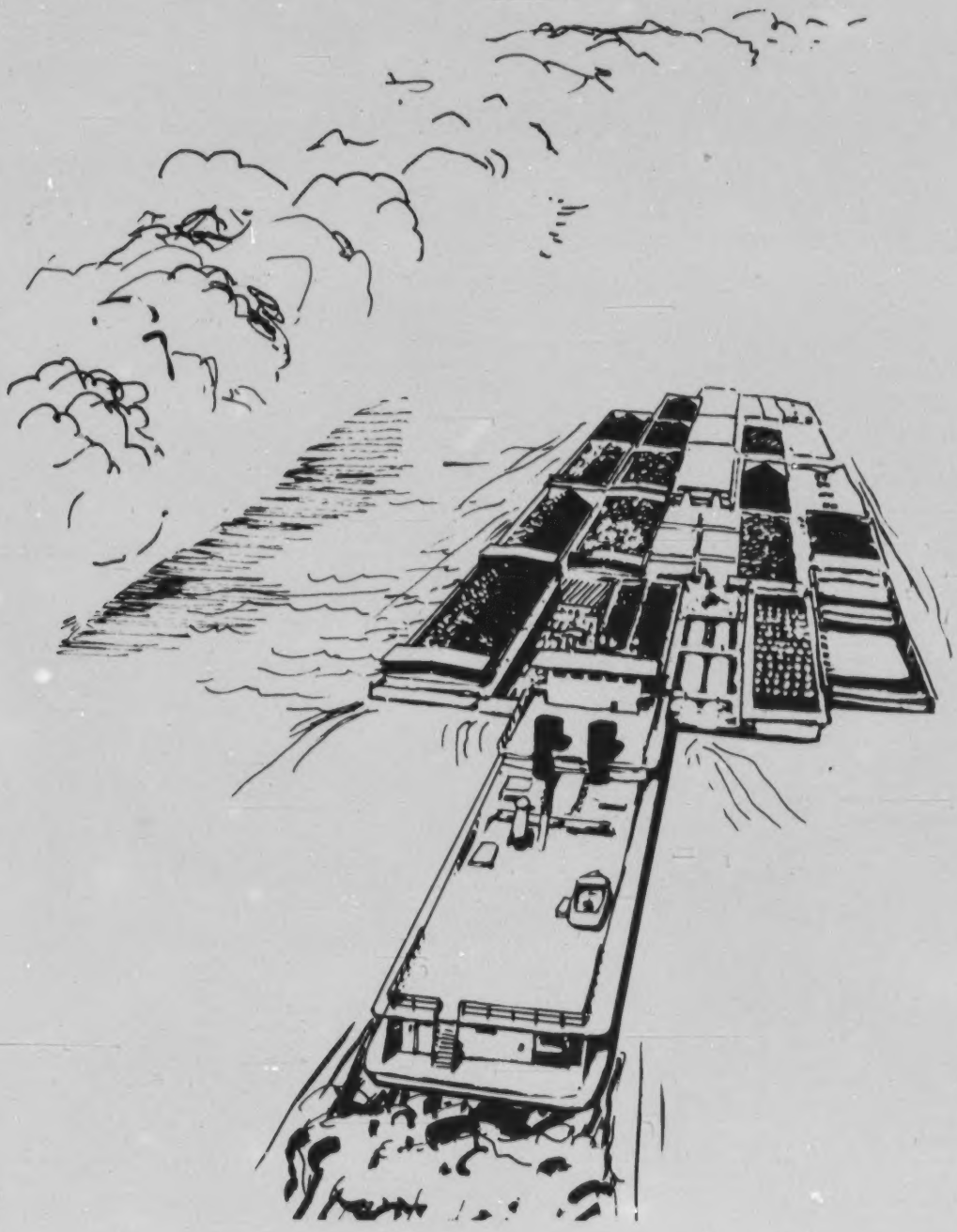
RIVER BOAT

R. GILMORE. CURR. DEVE. CNTR. UK. 993-7

GILMORE CORP. ARTS CNTR. MKE 993-10

CARGO VESSEL





INLAND WATER CARRIERS

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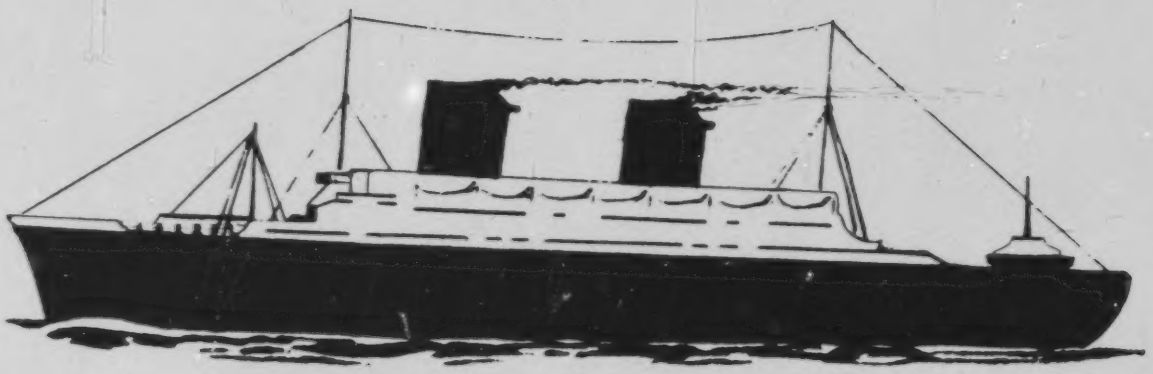
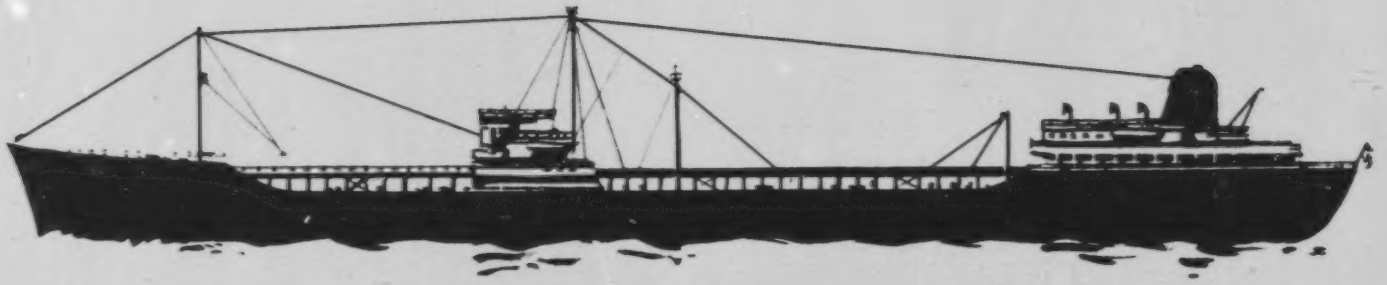
REMORE CORP. 2514 CASS AVE. DET. 201 993-9



OCEAN LINER

PHIPPS-STOUT: CURR. DEV. CNTR., U.K. 993-16

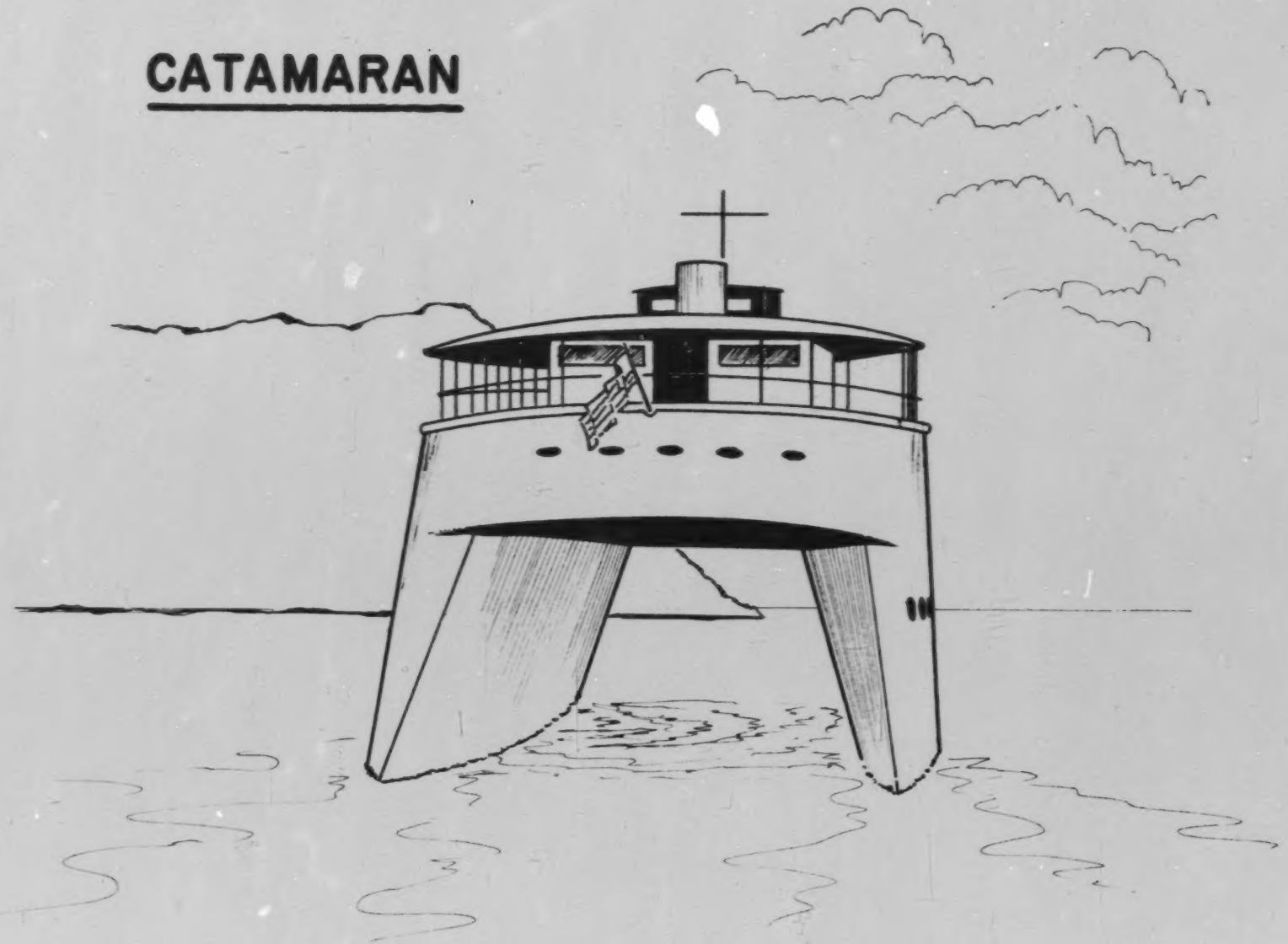


PETROLEUM TANKER

GILMORE CURR. DEVE. CNTR. UK. 993-6

151/152

CATAMARAN



UNIT FOUR

INTRODUCTION TO THE EXPLORATION

OF

OCCUPATIONS IN AIR TRANSPORTATION

UNIT PURPOSE: To explore, in depth, background information and occupational opportunities in air transportation.

PERFORMANCE OBJECTIVES: The student will be able to

I. Identify and discuss the broad range of occupational opportunities in air transportation.

II. Describe the development and functions of air transportation and analyze its importance to the economy.

III. Examine the employment trends and necessary skills outlook in air transportation.

IV. Describe, in depth, at least two air transportation jobs.

I. The student will be able to identify and discuss the broad range of occupational opportunities in air transportation.

A. Suggested Content

1. Career opportunities in building air craft can be classified into functional categories.

a. Designing and engineering category with examples of occupations

(1) Design draftsman
(2) Technical secretary
(3) Technical illustrator
(4) Artist
(5) Physicist
(6) Metallurgist
(7) Aerodynamicist
(8) Aeronautical design engineer
(9) Aerophysics engineer
(10) Standards and analyses engineer
(11) Wind tunnel test engineer
(12) Weight analyst
(13) Propulsion systems engineer

b. Airframe construction

(1) Airframe and powerplant mechanic
(2) Hydraulic mechanic
(3) Template maker
(4) Lay-out draftsmen
(5) Lay-out man
(6) Purchasing secretary
(7) Sheet-metal specialist
(8) Riveter
(9) Weldor
(10) Airframe electrician
(11) Metals finisher

c. Assembly, power and rigging

(1) Airframe and powerplant mechanic
(2) Electrical inspector
(3) Preflight inspector
(4) Machinist
(5) Engine assembler
(6) Hydraulic tester
(7) Equipment inventory clerk
(8) Electronics assembler
(9) Finishing inspector
(10) Stress analyst
(11) Fuel-system tester
(12) Controls engineer
(13) Fabric worker

d. Testing and inspecting

(1) Test pilot
(2) Flight engineer
(3) Navigator
(4) Communication systems operator
(5) Experimental mechanic
(6) FAA inspector
(7) Stress analyst
(8) Flight mechanic
(9) Fuel technician
(10) Instrumentation technician

e. Management and marketing

(1) Accountant
(2) Safety engineer
(3) Personnel manager
(4) Business vice-president
(5) Production manager
(6) Purchasing agent
(7) Corporation president
(8) Executive secretary
(9) Receptionist
(10) Telephone operator
(11) Marketing engineer
(12) Salesman
(13) Divisional manager

2. Airport Construction

Note: Refer to lessons in previous units for career information related to construction processes and employment.

3. Airport Operations

a. Examples of career opportunities, educational requirements and qualifications.

(1) Ticket sales agent

--High school graduate
--Formalized studies
--On-the-job training

(2) Reservation agent

--High school graduate
--Formalized studies
--On-the-job training

(3) Passenger service agent, customer service agent, station agent.

--High school graduate

--Three years experience in public contact work or three years of college.
--Typing skills required

(4) Clerical (secretary, typist, general clerk, accounting clerk, IBM key punch operator.

--High school graduate
--Possess skills qualifying for performance

(5) Flight kitchen (baker, cook, kitchen helper, dining service helper)

--On-the-job training

(6) Air freight (telephone sales agent, air freight agent)

--High school graduate
--Two years experience in public contact work or two years of college
--Typing skills required

(7) Data processing (controller, operator, programmer, systems analyst)

--Two years of college training and one year of business experience
--Must possess applicable skills

(8) Ramp and stores positions

--High school graduate
--Good physical condition

(9) Engineering and maintenance administration (sheet metal, line service, machinist, powerplant, airplane overhaul, electrical)

--High school graduate of G.E.D.
--Good vision
--Not over 25 years old
--Good mechanical aptitude
--Company apprenticeship program

(10) Line maintenance (plumber, carpenter, electrician, weldor, painter, auto mechanic, boilerman, metal plater)

--High school graduate or G.E.D.
--Two years related experience
--Company apprenticeship program

(11) Maintenance base mechanics

--High school graduate or G.E.D.

--Mechanical school training
--FAA license - for A & P mechanic
--Radio telephone license - for radio electric mechanic

4. Many other occupations are required to maintain services and functions of airports and aircraft.

   a. Air traffic management

      (1) Air traffic-control specialist
      (2) Airline radio operator
      (3) Schedule analyst
      (4) Truck driver, equipment operator
      (5) Fuel technician
      (6) Radar technician
      (7) Flight dispatcher

   b. Flight personnel

      (1) Pilot
      (2) Co-pilot
      (3) Navigator
      (4) Flight instructor
      (5) Radio operator
      (6) Flight engineer
      (7) Stewardess
      (8) Steward
      (9) Ground school instructor
      (10) License examiner

B. Suggested Teaching-Learning Activities

1. Write letters of request to airlines, aircraft companies, airports and aviation agencies for current information about career opportunities. See "Lockheed Today," p. 190.

2. Plan a visit to a commercial airport to observe operations and personnel functions. Follow up with a airport management person to discuss career opportunities with the students. Take photographs of people involved in jobs for later viewing and classroom discussion.

3. Students should identify a job in an occupational area which they feel might be an enjoyable work area and analyze why this job appeals to them.

C. Suggested Evaluation

1. Assign, according to expressed interest, career information reports. Each student should select an occupation and prepare it according to a predetermined format. When collected, evaluated and corrected, a reference inventory (notebook) could be initiated for school use. A copy might be welcomed in the school library.

D. Suggested Resources

1. Books

   a. Who, Me Fly

   b. Young People Science Encyclopedia, Volume 1

   c. Vision, The Story of Boeing

2. Booklets

   a. "Aircraft Maintenance Responsibilities"

   b. "American Airlines Scrapbook"

   c. "Functional Work Areas"

   d. "Magic of Airplanes"

3. Films

   a. "Air Transportation"

   b. "This Business is People"

   c. "This Could Be You"

   d. "Transportation In the Modern World"

   e. "Traveler Meets Air Traffic Control"

4. Filmstrips

   a. "Aviation, Where Career Opportunities are Bright"

5. Information Sheets

   a. Career Opportunities at United Air Lines

      (1) "Air Freight Positions"
      (2) "Clerical"
      (3) "Data Processing"
      (4) "Engineering and Maintenance Administration"
      (5) "Flight Kitchen"
      (6) "Line Maintenance Department"
      (7) "Line Mechanic"
      (8) "Maintenance Base Mechanics"
      (9) "Passenger Service Agent, Customer"
      (10) "Ramp and Stores Positions"
      (11) "Reservation Agent"
      (12) "Service Agent, Station Agent"
      (13) "Ticket Sales Agent"

NOTE: The information sheets listed on the previous page are available from United Air Lines.

5. Transparency Master

   a. "Lockheed Today," p. 190

II. The student will be able to describe the development and functions of air transportation and analyze its importance to the economy.

A. Suggested Content

1. The History of Flight

a. For many centuries men studied the flying ability of birds and experimented with winged contraptions.

(1) The Greek legend of Daedalus tells of how he escaped the King of Crete by flying to Sicily with wings of wax and feathers. However, his son, Icarus, flew too close to the sun and when the wax in his wings melted he fell to his death.

(2) Roger Bacon, described flying machines in his book, Secrets of Art and Nature, and Leonardo da Vinci produced several sketches featuring machines with flapping wings and airscrews. Da Vinci also was the first to describe the parachute.

(3) In the 1880's, Otto Lilienthal, experimenting with curved wings, built and flew curved wing gliders capable of carrying a man when wind conditions were favorable.

(4) The early experiments on curved-surface fixed wings proved the theory of lift.

(5) The Wright Brothers experimented with air foils (wings) of various designs in wind tunnels. Their experiments improved on Lilienthal's designs.

(6) Explaining the theory of lift

--When the top surface of the air foil (wing) is curved more than the bottom, air moves further and faster over the top surface than over the bottom and causes lower pressure on the top. The greater pressure on the wing's bottom surface forces it upward.

(7) Defining the basic factors essential to flight

--Lift - the upward forces on the air foil
--Weight - the total weight of the plane, its fuel, its cargo, and its passengers which lift must overcome
--Drag - pull of air passing rearward over the planes surface slowing forward motion
--Thrust - force required to overcome drag and move the plane through the air

(8) After making more than 1000 glider flights and building a lightweight jet powerful engine, the Wright Brothers successfully registered man's first powered flight of a fixed-wing aircraft.

--This historic event took place at Kitty Hawk, North Carolina, on December 17, 1903.
--The engine weighed 180 pounds and developed 16 horsepower.
--The flight lasted 12 seconds, and the craft flew 120 feet.

b. Progress in aircraft development has been tremendous in the twentieth century. Some significant events from the eighteenth, nineteenth, and twentieth centuries are listed in chronological order.

(1) 1783 - Joseph Montogolfier (French) built the first successful hot-air balloon.
(2) 1797 - Man's first parachute descent was accomplished. The jump was from a balloon at a height of 3000 feet.
(3) 1804 - George Coyley (British) experimented with model gliders.
(4) 1842 - W.S. Henson (British) built a steam-powered plane that incorporated advanced technical concepts. The craft never flew.
(5) 1852 - Henri Gifford (French) built and flew a steam-powered airship.
(6) 1884 - The French built a 160 foot airship powered by an electric motor.
(7) 1903 - The Wright Brothers flight was in this year.
(8) 1909 - Louis Bleviot (French) flew a 24 hp plane across the English channel.
(9) 1910 - Zeppelins (rigid frame) dirigibles provided passenger service in Europe and across the Atlantic into the 1930's.
(10) 1911 - First transcontinental flight of 4,321 miles required many stops and repairs and 84 days.
(11) 1914 - The largest airship ever built, the Hindenburg, was 803 feet long.
(12) 1918 - The world's first scheduled airmail route was scheduled between Philadelphia and Washington.
(13) 1926 - Richard Byrd (American) and Roald Admundsen (Norweigen) made transpolar flights in a monoplane and an airship, respectively.
(14) 1927 - Charles Lindbergh flew The Spirit of St. Louis, a single-engine monoplane, from New York to Paris, France for the first transatlantic nonstop flight.
(15) 1937 - The zeppelin Hindenberg was destroyed by fire.
(16) 1939 - Igor Sikorsky invented the first helicopter.
(17) 1939 - The first jet airplane was built in Germany.
(18) 1947 - The Bell X-1 rocket-powered aircraft flew 700 mph to become the first craft to exceed the speed of sound.
(19) 1949 - An American B-50 bomber made the first nonstop flight around the world.

(20) 1953 - The Douglas Skyrocket reached a record altitude of 83,235 feet. The same plane flew a speed record of 1,327 mph.
(21) 1955 - The Boeing 707 was put into service as the world's first big jet for passenger service.
(22) 1957 - Russia launched the first man-made satellite, Sputnik I.
(23) 1958 - America's first satellite, Explorer I was orbited.
(24) 1959 - Russia orbited the first manned orbiting vehicle.
(25) 1961 - Alan Shepard completed America's first manned space shot.
(26) 1963 - The rocket-powered X-15 flown by Joseph Walker reached a record altitude of 354,200 feet.
(27) 1965 - Russian and American space pilots performed space walks.
(28) 1966 - The United States and the Soviet Union achieved soft landings on the moon.
(29) 1968 - The United States achieved a moon-orbited manned flight.
(30) 1968 - Russia built and flew the world's first SST.
(31) 1969 - The United States began a series of moon explorations that continued into 1972.
(32) 1973 - Skylab flights of space science experimentation have proven man's continued pioneering spirit.

2. Building Airplanes

a. Aircraft construction is unlike the assembly-line production of automobiles.

b. Aircraft must be built to precise standards with rigorous quality control.

(1) Seemingly minor defects could prove disasterous.
(2) The major consideration in aircraft construction is strength.
(3) Aircraft are subjected to tremendous forces of stress.
(4) They must maintain structural soundness under many severe conditions.

--Vibration
--Extreme temperatures
--Moisture and corrosive factors
--Air pressures, high velocity, air currents, storms
--Operating forces from changes in speed, altitude and direction

(5) Weight is an important factor in design and construction.

--The heavier the craft, the larger the engine; both are factors which contribute to decreased maneuverability and smaller payloads.

(6) Early aircraft had wood frames and fabric skins.

(7) Modern aircraft have lightweight welded and riveted frames with riveted skins.

--Frame and skin construction are usually made from the alloys of magnesium and aluminum.
--Steel reinforcement spars are usually installed at points of greatest stress.

c. The components and parts of each aircraft are fitted carefully into place and carefully installed.

(1) Many construction processes are hand performed.
(2) Aircraft inspection processes are rigid.

--All new planes are tested thoroughly.
--New designs must be prototyped and tested extensively.
--FAA (Federal Aviation Agency) liscensing, periodic inspection and certification is required of all aircraft in use.

d. Power systems in modern aircraft

(1) Reciprocating piston engines are still in wide use, both in operating craft and newly built craft.

--Light planes
--Special purpose military craft and trainers
--Helicopters
--Cargo planes

(2) Most large commercial and military aircraft built since the late 1950's are powered by two, three or four gas turbine engines.
(3) Gas turbine engines are versatile and reliable.

--Operate on a variety of fuels
--Produce more power for their weight than piston engines
--Few moving parts
--Smooth operation with lack of vibration

(4) The gas turbine converts heat energy to useful power, such as mechanical energy or high speed thrust.

--The <u>generator section</u> compresses air and forces it into <u>burner section</u> mixed with atomized fuel.
--The power conversion section converts the resulting pressures (energy) into rotary motion (via turbine) for driving compressors and thrust for propulsion.

(5) There are several kinds of gas turbines.

--Ramjet - for hypersonic applications

--Supersonic jet - for supersonic planes
--Turbojet - for military planes
--Turbofan jet - for airliners
--Turboprop - for smaller transports, cargo craft
--Turboshaft - for helicopters and some land vehicles

3. Types of Aircraft

a. Modern aircraft are designed and used for many special purposes.

b. Transport aircraft for passenger service vary in size and versatility.

(1) Large airline companies utilize jet craft capable of carrying many passengers over long distances at high speeds.

--Boeing 747 is the largest commercial jet. Speed - 600 mph.
--Douglas DC-10 is an ultramodern jet designed to accomodate 222 passengers. Speed - 600 mph.
--Concorde (Britain and France) SST is capable of maximum speeds reaching 1500 to 1800 mph.

c. Short-distance passenger aircraft are used by small airlines, private companies and charter flights.

d. Nonrigid airships, once used for navy military operations, are utilized for advertisement purposes and for television filming at sporting events, parades and special occasions.

e. Helicopters are used for short distance passenger service, traffic patrol, space movement and placement of structural components, rescue operations, news retrieval, freight delivery, private transportation and many military operations.

f. VTOL (Vertical Take-Off and Landing) craft are designed for special uses where runways are limited or unavailable.

g. Planes used for air freight services are generally bulkier and slower than commercial airliners. Many propellor-driven craft are still in use.

h. Private flying is becoming increasingly popular. Many craft are single engine, two and four passenger planes. Small jets, twin-engine planes, vintage planes, refurbished military craft, racing planes, gliders, kit built, and special designed, hand-crafted planes are popular.

i. Military aircraft design generally sets the technological pace.

(1) Totally automated control systems
(2) Highly advanced communication systems
(3) New power systems and adaptations
(4) Safety systems

j. Research in military aviation costs many millions of dollars annually and creates thousands of civilian jobs.

k. The United States builds and markets military aircraft and equipment for many foreign countries.

4. Space Age Technology

Note: In order to effectively organize an instructional approach to this topic, it is urged that the teacher secure the materials available from the National Aeronautics and Space Administration. Refer to resources section.

a. Although the space age is in its infancy, many technological dividends have resulted. Examples of major areas of benefits:

(1) Communications
(2) Education
(3) Transportation
(4) Medicine
(5) Environment
(6) Ecology
(7) Manufacturing
(8) Weather forecasting
(9) Photography
(10) Power conservation
(11) Human nutrition
(12) Crop surveillance
(13) Pest control
(14) Safety systems
(15) International understanding

b. The complexity of the world of work has increased immeasurably as space technology expands.

(1) The shock of "Sputnik I" and the forward thrust of the American space program created new occupations, categories, titles, and responsibilities.

--The shortage of scientists and technicians created higher school enrollments in these areas.

(2) The possibilities for invention, production, and research in space exploration and supportive activities are inducements into this area.

(3) The early "glamour" of television coverage and national pride made work in space technology desirable.
(4) The slowdown of the space thrust after the dramatic "moon walks" cause major unemployment in the space industry.

--Scientists were too specialized and too abundant.
--Some Ph.D. physicists became taxi drivers.

(5) The space industry will very likely engage in new expansion in the near future.

--A joint space venture is planned with the U.S.S.R.
--Construction of a space platform is planned.
--The space platform and shuttle craft will make space exploration safer and easier.

c. The flow of research and applied space age technology will tend to widen the already critical "educational gap" unless schools plan thorough programs to pursue this complex area.

(1) Students should have the opportunity to explore the major areas of space age progress.
(2) Several academic approaches can be utilized.

--Historical review
--Technological review
--Practical involvement (hands on activities)

B. Suggested Teaching-Learning Activities

1. Ask students to display models of planes that they have built. Point out to the class that the construction of wood and fabric flying models represents many construction techniques and problems to be encountered in building full-size aircraft.

2. Have a student or a team of students demonstrate the assembly of a plastic model craft which are usually built from preformed sections, such as wings, fuselage, tail section, etc.

3. Prepare and present a classroom demonstration of how a jet engine works.

a. Tie a string or light wire from one end of the room to the other.

b. Bend a paper clip 90° to form a right angle.

c. Inflate a long (cylinder design) toy balloon. Hold off pressure escape while taping one leg of paper clip to the balloon.

d. Ask students to explain why the balloon travels rapidly along the string.

e. Explain Newton's third law that "Every action has an equal and opposite reaction."

4. Plan a model flying day when students wishing to participate may bring powered plane models and demonstrate their operating skills.

5. Arrange for an A & P (Airframe and Powerplant) mechanic to lead a class discussion on aircraft construction and related job opportunities.

6. Design, build and fly paper and/or balsa gliders.

7. View films on the history and progress of flight and space travel.

   Note: Refer to resources for this lesson.

8. Visit an air museum. Take camera along for later slide and picture viewing and class discussion.

9. Students can demonstrate Bernoulli's principle that the faster a fluid flows over a surface or through a passage, the less pressure it exerts on its surrounding. Where velocity is high, the pressure is low. See "Demonstrating Bernoulli's Principle," p. 191.

   a. Insert a straight pin through the center of a two-inch square of paper.

   b. Lay the paper flat on a table or desk top with the pin pointing up. Place a common sewing thread spool over the pin.

   c. Blow a stream of air directly into the spool hole. The paper will cling to the bottom of the spool.

   d. This physical phenomenon demonstrates how lift affects an air foil.

10. Have students prepare a list of ten types of aircraft, associating each with its most common use. See "Crop Duster," p. 192, "Fighter-Bomber," p. 193, "Military Cargo," p. 194, "Military Trainer," pp. 195-196, "ZPG-3W," p. 197, "Private Commuter," p. 198, "Sailplane," p. 199, "Six Passenger Transport," p. 200, "Transport Helicopter," p. 201, "Military Bomber," p. 202, and "Jet Transport," p. 203.

11. Invite an airlines official, an aircraft designer, an air force officer or a retired air service military person to direct a class discussion concerning the types and uses of aircraft.

12. Secure photographs, prints or drawings of various types of aircraft for purposes of preparing displays and reference notebooks.

    Note: Airline companies, federal agencies and educational organizations will supply many such items at no cost.

13. Prepare a multiple choice quiz including items concerning structural, power, construction technology and occupational categories.

14. Have the students select a flight pioneer, inventor, or a person who contributed to air and/or space flight progress for preparation of written biographical sketches.

15. An experimental wind tunnel can be constructed by forming open cylinders from heavy construction or drawing paper. Paper milk cartons or plastic milk jugs with ends removed are also suitable for constructing wind tunnels.

    a. Secure the cylinders to a soft wood, flat board with a hand-stopper.

    b. A blade-type fan, used either to push or pull an air stream through the tunnel, will provide an air flow sufficient to test small paper or balsa wood air foils. Two-point suspension using light weight thread will usually prevent the air foils from erratic spinning.

16. Prepare a written quiz including questions on lift, weight, drag and thrust. Also design a section for matching of names to significant events.

17. Have students demonstrate and/or explain the theory of lift.

18. Conduct an unrehearsed panel discussion on the history of flight after completing a thorough review of this lesson.

19. Collect news clippings and magazine articles concerning current space science activities being conducted by the United States and other nations.

20. Collect news articles of past space achievements and prepare a scrapbook of these historical events for display in the school.

21. Schedule and view movies available from NASA.

22. Display charts available from NASA

23. Plan and conduct suggested lessons and activities in NASA publications.

24. Build model rockets and plan a rocket launching day when all students can observe the results. See "Constructing Rocket Body," p. 204-206.

NOTE: Plans for building inexpensive rockets are contained in the supportive materials of this unit. Also, rocket kits are available from local hobby and craft stores. Inexpensive rocket engines are available for the kits in the price range of 25 cents. It must be stressed to students that rockets can be launched only under expert adult supervision, using maximum safety precautions. Laounching should be carried out in a large open field, away from trees and buildings so as to assure recovery of the models. It is suggested that the first launching attempts to be supervised by the owner or manager of a model or hobby store or by officers or members of an organized rocket club. The directions in this unit are for building the rockets only. No attempt has been made to discuss ignition systems, launching apparatus or techniques, weather conditions or specific safety precautions.

25. Have students prepare and present technical, historical, occupational and educational reports related to this section of the unit on Air and Space Transportation.

C. Suggested Evaluation

1. Ask each class member to project an "idea" or an "innovation" as he or she would view its application to the future of aviation. These suggestions could be applicable to new power systems, new basic designs, new methods of construction, suggestions for components and accessories or unexplored uses for aircraft. There should be no limits placed on the imaginative suggestions. These suggestions should be written descriptively and accompanied by sketches or plans. They could further be submitted for class discussion and opinion.

D. Suggested Resources

1. Books

a. Aerospace Bibliography

b. Aerospace Curriculum Resource Guide

c. Aircraft and How They Work

d. Aircraft at Work

e. Apollo Supplement

f. Fundamentals of Aviation

g. History of Flight

h. Junior Airman's Book of Airplanes

i. Life Science in a Space Age Setting

j. Planes and How To Draw Them

k. Seven Steps to a Career in Space Science and Technology

l. Sky Pioneers - The Story of Wilbur and Orville Wright

m. Twenty Smiling Eagles

n. United States Aircraft, Missiles and Space Craft

o. Vision, The Story of Boeing

p. Who, Me Fly

2. Booklets

a. "People Movers"

b. "Space Jobs"

c. "Spacecraft Power"

d. "Space Exploration"

3. Charts

a. "Airliners of Tomorrow"

b. "Airplanes Are Built to do Many Kinds of Tasks"

c. "First Airplanes"

d. "Friendly Skies Air Atlas"

e. "Gas Turbine Engine"

f. "How an Instrument Landing System (ILS) Works"

g. "Journey to the Moon"

h. "Lockheed Pathways to the Stars"

i. "Piston-Engine Era"

j. "707 Astrojet Flight Deck"

k. "Today's Jet-Powered Passenger Airliners"

l. "We'd Like You to Meet United's DC-10 Friend Ship"

m. "What Makes a Jet Jet"

4. Films

a. "Airplanes: Principles of Flight"

b. "Airplanes Work for Us"

c. "History of Aviation, Parts I - III"

d. "How Air Helps Us"

e. "History of Flight - Wright Brothers Parts I - V"

5. Instructional Sheets

a. "Constructing Rocket Body"

b. "Developing and Attaching Fins"

c. "Finishing and Assembling"

d. "Forming Nose Cone"

e. "Stablizer Fin Gluing Jig"

6. Pamphlets

a. "Improving the Environment"

b. "Most Asked Questions About Space and Aeronautics"

c. "NASA Educational Publications"

d. "NASA Film List"

e. "Pioneer, Mission to Jupiter"

f. "Why Planes Fly"

7. Resource Persons

a. Aircraft designer

b. Airforce officer

c. Airlines official

d. Retired air service military person

8. Transparency Masters

   a. "Demonstrating Bernoulli's Principle," p. 191

   b. "Crop Duster," p. 192

   c. "Fighter-Bomber," p. 193

   d. "Military Cargo," p. 194

   e. "Military Trainer," p. 195, 196

   f. "ZPG-3W," p. 197

   g. "Private Commuter," p. 198

   h. "Sail Plane," p. 199

   i. "Six Passenger Executive Transport," p. 200

   j. 'Transport Helicopter," p. 201

   k. "Military Bomber," p. 202

   l. "Jet Transport," p. 203

   m. "Constructing Rocket Body," pp. 204 - 206

III. The student will be able to examine the employment trends and necessary skills outlook in air transportation.

A. Suggested Content

1. There has been a continual increase in the numbers of people employed in air transportation.

   a. The exception has been the decline since the high of 1968 during the Viet Nam conflict and the height of the space exploration.

   b. The growth trend is expected to continue thru 1980.

   c. Some job openings will arise each year due to job changes, retirement or deaths.

   d. Growth in all areas is anticpated.

      (1) Air Traffic control increases will be greatest

2. There are three job categories in air transportation

   a. Professional and technical

      (1) 1/4 of all workers are scientists and engineers
      (2) 30 different college degrees are represented

   b. Administrative, clerical and related work

   c. Plant

      (1) Represents 1/2 of all air transportation workers

3. There are three major work areas in air transportation

   a. Aerospace engineering

      (1) Employed more than 60,000 in 1970
      (2) Employment fluctuation caused by defense expenditures
      (3) Narrow skill specialization adversely affected by skill shift or obsolescence
      (4) Requires greater academic background
      (5) High paying areas of employment
      (6) Possibilities of continuing development

          --Subsonic and supersonic aircraft
          --Vertical lift aircraft
          --Missiles (safeguard anti-ballistic missile system)
          --High speed ground transport

   b. Manufacturing of aircraft

(1) Employed 1.25 million in 1970

--Scientists, engineers and technicians represent a large and growing proportion.
--1/6 are women.

(2) Employment distribution of total work force

--4000,000 in missiles and spacecraft
--600,000 in aircraft
--200,000 in electronic equipment for aircraft and spacecraft
--Remainder worked for NASA

(3) Higher paying than other manufacturing areas

--Averages in 1970, $168.92/week compared with $133.73

(4) Possibilities for continuing development

--The United States supplies military and commercial aircraft for many other countries.
--Air transportation should continue to develop as a means of mass transportation.
--The space program could enter another period of expansion.

c. Civil aviation occupations

(1) Employed 300,000 workers in 1970

--80% of total (240,000) were involved with service and operation of domestic routes.
--1/5 of the 240,000 were involved with flight
--50,000 workers were involved with international service.
--There were 18,000 pilots.
--There were 52,000 mechanics.

4. Air Freight Transportation

a. Accounts for less than 1% of all freight transportation volume.

b. Has the greatest projected increase of all means of freight transportation.

(1) 18.5% through 1975
(2) 17.8% through 1980

c. Experimentation with jet powered dirigibles may cause a greater expansion of air freight transportation.

NOTE: The following questions have been provided to prompt investigative diagnosis of trends and outlooks by the students. The list may be expanded upon by both teacher and students.

5. Is there an air transportation industry in the area?

6. Is this industry manufacturing or service?

7. How active is the industry and does it exhibit a growth pattern?

8. If the industry is a service, are there indications of area population growth and expansion?

9. What are present skills and future skills requirements?

10. What educational background is required?

B. Suggested Teaching-Learning Activities

1. Have each student determine the major invention, events, or innovations that contributed most to the growth of air transportation.

2. Have each student select a career in air transportation and determine what skills are needed for the performance of that job today. What skills were needed twenty-five years ago but are not needed today? What skills may be required ten years from today?

3. Have students speculate on how they believe air freight will move in the future.

4. Determine the nearest air transportation industry. Contact this industry to learn from them the net change in personnel numbers within the last ten years. Where were these changes made? See "Kentucky Airports," p. 207.

5. Plan a display of pictures depicting the evolution of airplane construction and design. Have the students design their own design projections to add to the display.

6. Have a representative from an airport or civil air patrol discuss with the students the employment outlook for the area.

C. Suggested Evaluation

1. Have each student compile a list of the most available and the most lucrative jobs in air transportation as projected for the 1980's. Evaluate the lists according to the information gathered concerning the employment outlook.

D. Suggested Resources

1. Books

   a. Occupational Outlook Handbook

2. Booklets

   a. "Annual Report, 1972"

   b. "Employment Outlook for Aircraft, Missile and Spacecraft Manufacturing"

   c. "Guide to Federal Career Literature"

   d. "High School Aviation Aerospace Education Status Report"

   e. "United States Department of Transportation - Facts and Fiction"

   f. "50 Years of Service to the Community, the Nation, and the World"

3. Films

   a. "Airports in Perspective"

   b. "The Lockheed - Georgia Company"

4. Reprint

   a. "American Airlines - The Plane That Broke the Profit Barrier"

5. Resource Persons

   a. Airport representative

   b. Civil air patrol member

6. Transparency Master

   a. "Kentucky Airports," p. 207

IV. The student will be able to describe, in depth, at least two air transportation jobs.

A. Suggested Content

1. Aviation Pilot

a. Employment outlook

(1) A rapid rise in employment is expected through the 1970's for commercial pilots.

--Increased passenger traffic
--Increased cargo traffic

(2) Pilots in general aviation will be greatly needed

--Business flying
--Air taxi service
--Patrol flying
--Survey flying

b. Earnings

(1) Among highest paid wage earners in the country
(2) Earnings depend on several factors

--Type, size, and speed of plane
--Number of hours and miles flown
--Length of service

(3) Domestic air transportation captains averaged $30,000 a year in 1970.
(4) International pilots averaged $37,000 a year in 1970.
(5) Some senior captains may earn $48,000.
(6) Airline pilots cannot fly more than 85 hours a month.
(7) Total duty hours usually average 100 hours a month.

c. Job characteristics

(1) Operates the controls and performs tasks necessary for flying a plane, keeping it on course and landing it safely
(2) Supervises co-pilot, flight engineer, and flight attendants
(3) Confers with meteorologist about weather conditions
(4) Prepares flight plans
(5) Checks the operation of each engine before take-off
(6) Checks functioning of the planes instruments, controls, and electronic and mechanical systems
(7) Radios to ground controls during flight
(8) Checks landing equipment
(9) Files flight reports

d. Educational requirements and other qualifications

(1) High School graduate

--Two years college required by some airlines
--College graduates usually preferred

(2) FAA license
(3) Commercial pilots -- 18 years old with 200 hours of flight experience
(4) Airline transport pilots -- 23 years old with 1,500 hours of flight time within three years

--Night flying
--Instrument flying

(5) Airlines prefer following qualifications

--Between 21 and 28 years of age
--5'6" to 6'4"
--140 to 210 pounds
--At least 20/100 vision corrected to 20/20
--Good hearing
--Outstanding physical stamina

(6) Require a "restricted" radio-telephone operator permit issued by FCC

2. Flight Attendants

a. Employment outlook

(1) Several thousand will be needed each year to replace about 30 percent of those who will resign each year.

b. Earnings (1970)

(1) Beginning flight attendants earned approximately $523.00 to $645.00 per month.
(2) Flight Attendants with 2 years experience earned $487.00 to $836.00 per month.
(3) Domestic flights averaged $600.00 per month.
(4) International flights averaged $800.00 per month.
(5) Flight time is limited to 80 hours a month.
(6) They may work up to 35 hours a month on ground duties.
(7) They may have 15 days off each month.

c. Job characteristics and duties

(1) Aboard commercial planes to make passenger flight safe, comfortable and enjoyable

(2) Checks emergency equipment, supplies and necessary food and beverages
(3) Greets passengers and checks their tickets
(4) Checks seat belts and gives instructions
(5) Answers questions

--Flight
--Weather

(6) Serves food and beverages
(7) Distributes pillows and reading material
(8) Completes flight reports

d. Educational requirements and other qualifications

(1) High school graduate

--Prefer 2 years of college or business experience

(2) Airlines training schools

--Newly hired flight attendants usually given five weeks training

(3) Must be at least 20 years old
(4) Must be 5'2" to 6'0" tall in stocking feet

--Weight proportional to height

(5) Must be neat and attractive with clear complexion, have high moral character and a good speaking voice
(6) Must have excellent health
(7) At least 20/100 uncorrected vision

--Corrected to 20/20
--Must have worn contacts for at least 6 months
--No glasses permitted

e. Advancement

(1) Training
(2) Reserve flight attendants
(3) Flight attendant
(4) First flight attendant
(5) Purser
(6) Supervising flight attendant
(7) Flight attendant instructor or recruiting representative

3. Private airport lineman

a. Earnings

(1) $340.00 to $480.00 per month

b. Job characteristics and duties

(1) Services aircraft and does related work
(2) Meets and directs aircraft on the ramp
(3) Assists in deplaning of passengers
(4) Refuels and secures aircraft
(5) Operates tow tugs and ramp equipment
(6) Keeps records on sales
(7) Does general housekeeping duties

c. Educational requirements and other qualifications

(1) Eighth grade education
(2) Four years service

--Servicing aircraft
--Automotive servicing
--Airport maintenance

d. Special knowledge, skills and abilities

(1) Thorough knowledge of aircraft
(2) Thorough knowledge of occupational hazards and safety precautions
(3) Ability to meet and deal with the public
(4) Ability to handle cash and keep records
(5) Manual dexterity
(6) Physical strength

B. Suggested Teaching-Learning Activities

1. The instructor should schedule a field trip to a nearby airport to observe the operations. See "Kentucky Airports" p. 207.

2. Some airports have introductory flight experiences that are relatively inexpensive. The teacher might suggest that the students have their parents take them on such a flight if they have never flown before.

3. There are flag signals used for landing aircraft on aircraft carriers. The students should research these signals and learn a few. The students will then be required to simulate the operation of landing a plane by giving the appropriate signal while the teacher tells the student how the plane is manuevering. There should be time limits for performing these signals in order to prevent a "crash."

4. Students should research the following occupations: flight engineer, aircraft mechanic, airline dispatchers, air traffic controller, ground radio operator and teletypist, and traffic agent and clerk. The students should be able to describe these occupations and outline the responsibilities.

5. Students should act out situation dramas for service crew members and passengers.

   a. Purchasing flight tickets and insurance

   b. Boarding and exiting a plane

   c. Passenger with air sickness

   d. Bad weather conditions

      (1) Before flight
      (2) During flight

   e. Air emergency

   f. Customs check

C. Suggested Evaluation

1. Have each student select an occupation of his choice and do an in-depth analysis of that occupation.

D. Suggested Resources

1. Books

   a. Occupations and Careers

   b. Occupational Outlook Handbook

   c. Department of Transportation

2. Booklets

   a. "Aircraft Maintenance Responsibilities"

   b. "Functional Work Areas"

3. Films

   a. "Astronaut Training"

   b. "Come Sail With Me"

   c. "From the Ground Up

   d. "The Hard Ones"

   e. "How to Succeed Without Really Flying"

   f. "The Other Passenger"

   g. "Second Seat"

4. Transparency Master

   a. "Kentucky Airports," p. 207

SUPPORTIVE MATERIAL

FOR

UNIT FOUR

REFERENCE LIST FOR UNIT FOUR

BOOKS

1. Aerospace Bibliography Compiled for National Aeronautics and Space Administration by National Aerospace Education Council

2. Aerospace Curriculum Resource Guide Massachusetts Department of Education in cooperation with National Aeronautics and Space Administration

3. Aircraft and How They Work by William P. Gottlieb, Doubleday Books, 1960

4. Aircraft at Work by Mary Elting, Harvey Publishing Co., 1964

5. Airplanes and Trucks and Trains, Fire Engines, Boats and Ships and Building and Wrecking Machines by George Zaffo, Grosset and Dunlap Publishers, 1966

6. Apollo Supplement Office of Manned Space Flight, prepared by: Apollo Program Office - MAO, April 1970

7. Fundamentals of Aviation by Leslie A. Bryan, Institute of Aviation, University of Illinois, 1964

8. History of Flight by Arthur Golden, Golden Press, 1964

9. Junior Airman's Book of Airplanes by Clive E. Davis, Dodd Publishers, 1960

10. Life Science In A Space Age Setting A report submitted to the National Aeronautics Space Administration developed at: Wayne State University

11. Occupational Outlook Handbook United States Government Printing Office

12. Occupations and Careers by Feingold and Sunerdloff, Webster Division, McGraw-Hill Book Company

13. Planes and How to Draw Them by Amy Hageboom, Vangard Publishers, 1955

14. Seven Steps to a Career in Space Science and Technology The National Aeronautics and Space Administration through The Ohio State University Research Foundation, 1966

15. Sky Pioneers: The Story of Wilbur and Orville Wright by Jeanne Gardner, Harcourt Publishing Company

16. Twenty Smiling Eagles by Walter and Ann Bohrer, Vantage Publishing Company, 1962

17. United States Aircraft, Missiles and Space Craft National Aviation Education Council

18. Vision, The Story of Boeing by Harold Mansfield, Popular Library, 1966

19. Who, Me Fly by Robert Scharff, Tower Publishers Inc.

20. Young People Science Encyclopedia, Vol. I Children's Press, 1966

BOOKLETS

1. "Aircraft Maintenance Responsibilities," Department of Transportation

2. "American Airlines Scrapbook," American Airlines, Air Age Education Department

3. "Annual Report, 1972," The Boeing Company

4. "Employment Outlook For Aircraft, Missle and Spacecraft Manufacturing," U.S. Dept. of Labor, U.S. Government Printing Office

5. "50 Years of Service to the Community, the Nation, and the World," McDonald Douglas Corporation, 1970

6. "Flying Machine: First Cousin To The Bird," Cessna Aircraft Co.

7. "Functional Work Areas," The Boeing Company, Technical Employment Office

8. "High School Aviation Aerospace Education Status Report," National Aerospace Education Association

9. "Magic of Making Airplanes," Cessna Aircraft Company, Air Age Education Division

10. "Magic of Modern Airplanes," Cessna Aircraft Company

11. "People Movers," Carlos C. Villarreal, Aerospace Industries Association

12. "Spacecraft Power," William R. Corliss, National Aeronautics and Space Administration

13. "Space Exploration," Edgar M. Cortright, Educational Programs and Services Office, NASA

14. "Space Jobs," The National Aeronautics and Space Administration through The Ohio State University Research Foundation, 1966

CHARTS

1. "The Airliners of Tomorrow," American Airlines, available from Air Age Education, Cessna Aircraft Company

2. "Airplanes Are Built to Do Many Kinds of Tasks," Cessna Aircraft Corporation, Air Age Education Division

3. "The First Airliners," American Airlines, available from Air Age Education, Cessna Aircraft Company

4. "The Friendly Skies Air Atlas," United Air Lines

5. "The Gas Turbine Engine," Airsearch Manufacturing Company of America

6. "How An Instrument Landing System (ILS) Works," American Airlines Air Age Education Department

7. "Journey to the Moon," an educational publication of the National Aeronautics and Space Administration

8. "Lockheed Pathways To The Stars," Lockheed Aircraft Corporation

9. "The Piston-Engine Era," American Airlines, available from Air Age Education, Cessna Aircraft Company

10. "707 Astrojet Flight Deck," American Airlines, Air Age Education Department

11. "Today's Jet-Powered Passenger Airliners," American Airlines, available from Air Age Education, Cessna Aircraft Company

12. "We'd Like You To Meet United's DC 10 Friend Ship," United Airlines

13. "What Makes a Jet Jet," American Airlines, Air Age Education Department

FILMS

1. "Airplanes: Principles of Flight," Cessna Aircraft Company

2. "Airplanes Work For Us," 16mm, Churchill Films

3. "Airports In Perspective," 16mm, Federal Aviation Administration

4. "Air Transportation," 16mm, Library Films, Inc.

5. "Astronaut Training," 16mm, National Aeronautics and Space Administration

6. "Come Sail With Me," 16mm, Department of the Navy, 1966

7. "From the Ground Up," 16mm, Federal Aviation Administration, 1969

8. "History of Aviation: Parts I, II, & III," 16mm, Department of the Army, 1960

9. "History of Flight: Parts I, II, III, IV, & V," 16mm, Federal Aviation Administration, 1971

10. "The Hard Ones," 16mm, National Aeronautics and Space Administration

11. "How Air Helps Us," Cessna Aircraft Company

12. "How To Succeed Without Really Flying," 16mm, Federal Aviation Administration, 1970

13. "The Lockheed-Georgia Company," Lockheed-Georgia Co.

14. "The Other Passenger," 16mm, Federal Aviation Administration, 1965

15. "Second Seat," 16mm, Department of the Navy, 1964

16. "This Business Is People," 16mm, Lockheed-Georgia Company, 1965

17. "This Could Be You," 16mm, Piper Aircraft Corporation

18. "Transportation In The Modern World," Cessna Aircraft Company

19. "Traveler Meets Air Traffic Control," 16mm, Federal Aviation Administration, 1963

FILMSTRIP

1. "Aviation, Where Career Opportunities Are Bright," U.S. Office of Education, Federal Aviation Administration, National Aerospace Education Council

KITS

1. Cessna/American Airlines Elementary Education Kit, (Price $4.95) Cessna Aircraft Company

2. Display Kit - contains charts, games, pictures, exploded views and printed instrument panel, (Price $1.50), Cessna Aircraft Co.

3. Picture Set - "Planes Past to Present," United Air Lines

4. Plastic Model - for demonstration; with movable parts, (Price $1.00) Cessna Aircraft Company

PAMPHLETS

1. "Improving The Environment," United Airlines

2. "Most asked questions about Space and Aeronautics," National Aeronautics and Space Administration

3. "NASA Educational Publications," National Aeronautics and Space Administration

4. "NASA Film List," National Aeronautics and Space Administration

5. "Pioneer, Mission To Jupiter," National Aeronautics and Space Administration

6. "Why Planes Fly," American Airlines, Air Age Education Department

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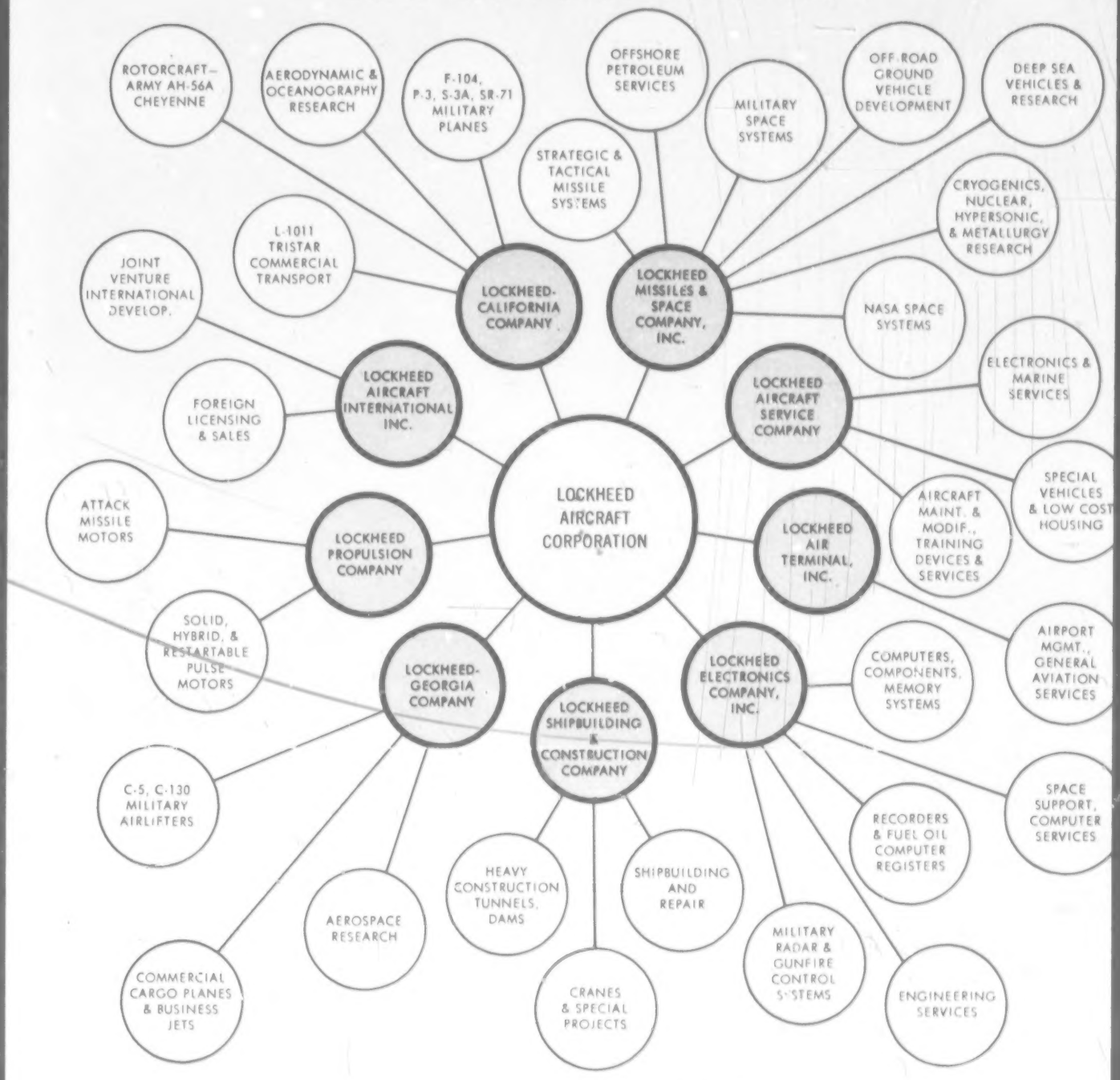
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OFFSHORE PETROLEUM SERVICES
MILITARY SPACE SYSTEMS
OFF-ROAD GROUND VEHICLE DEVELOPMENT
DEEP SEA VEHICLES & RESEARCH
STRATEGIC & TACTICAL MISSILE SYSTEMS
CRYOGENICS, NUCLEAR, HYPERSONIC, & METALLURGY RESEARCH
L-1011 TRISTAR COMMERCIAL TRANSPORT
JOINT VENTURE INTERNATIONAL DEVELOP.
NASA SPACE SYSTEMS
ELECTRONICS & MARINE SERVICES
FOREIGN LICENSING & SALES
SPECIAL VEHICLES & LOW COST HOUSING
AIRCRAFT MAINT. & MODIF., TRAINING DEVICES & SERVICES
ATTACK MISSILE MOTORS
SOLID, HYBRID, & RESTARTABLE PULSE MOTORS
AIRPORT MGMT., GENERAL AVIATION SERVICES
COMPUTERS, COMPONENTS, MEMORY SYSTEMS
C-5, C-130 MILITARY AIRLIFTERS
SPACE SUPPORT, COMPUTER SERVICES
RECORDERS & FUEL OIL COMPUTER REGISTERS
HEAVY CONSTRUCTION TUNNELS, DAMS
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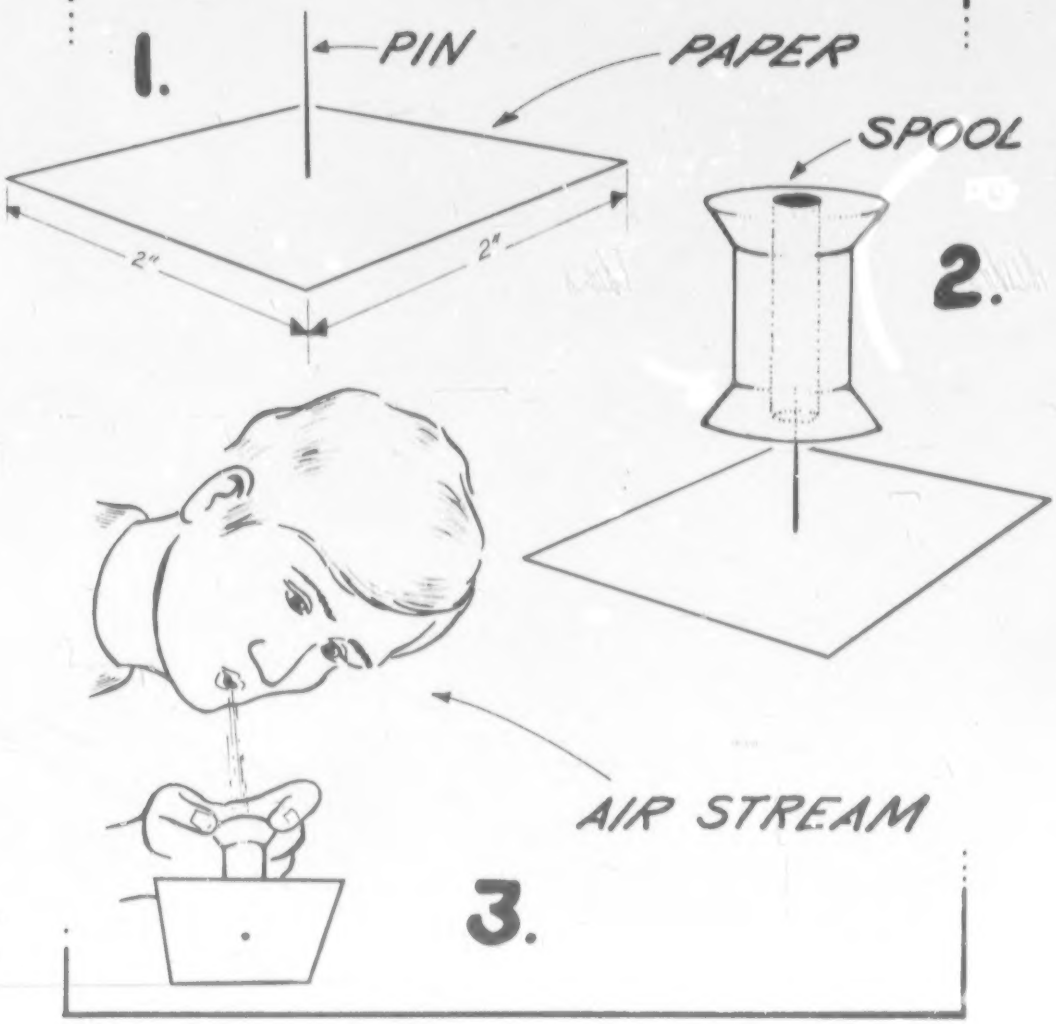
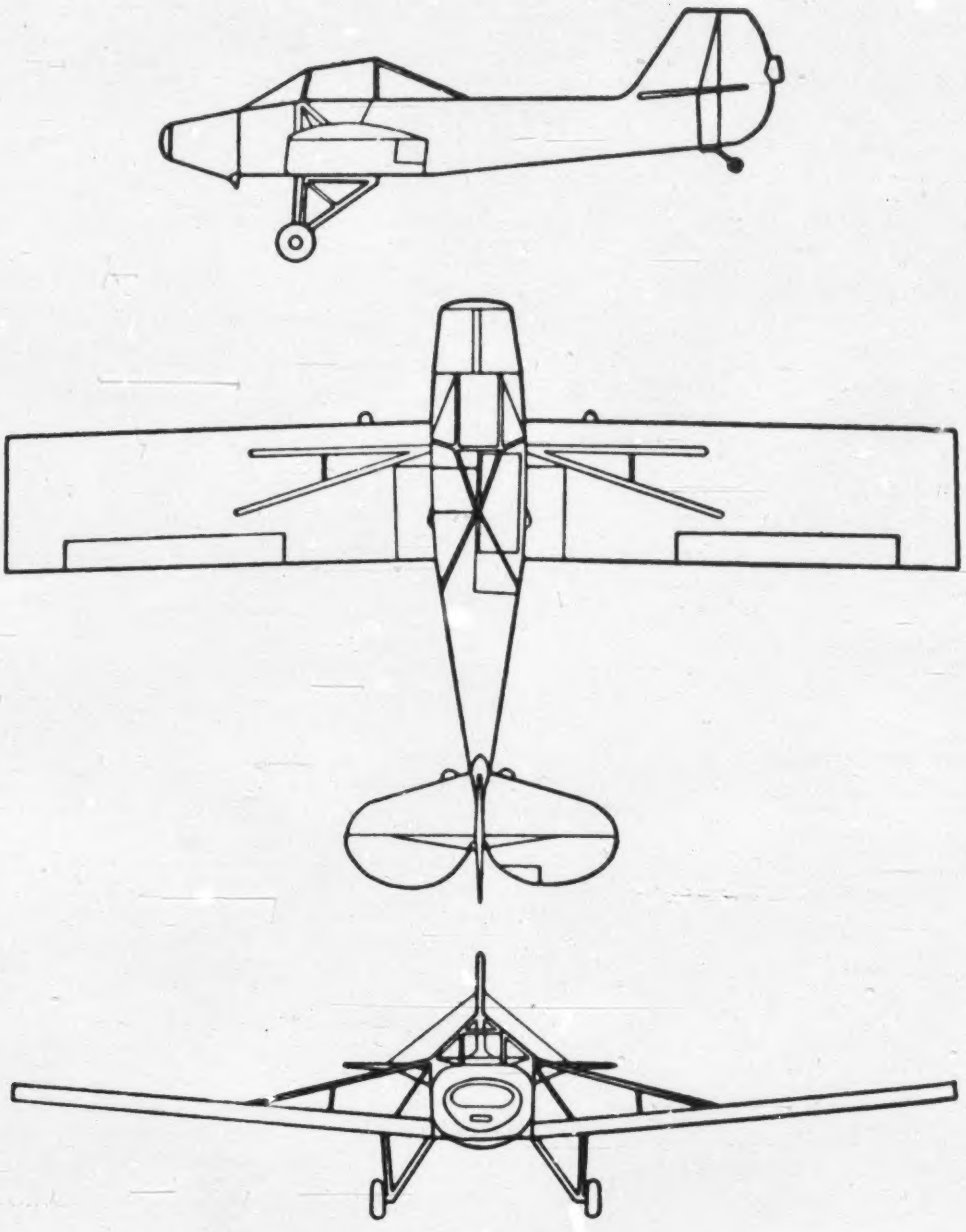
DEMONSTRATING BERNOULLI'S PRINCIPLE



CROP DUSTER



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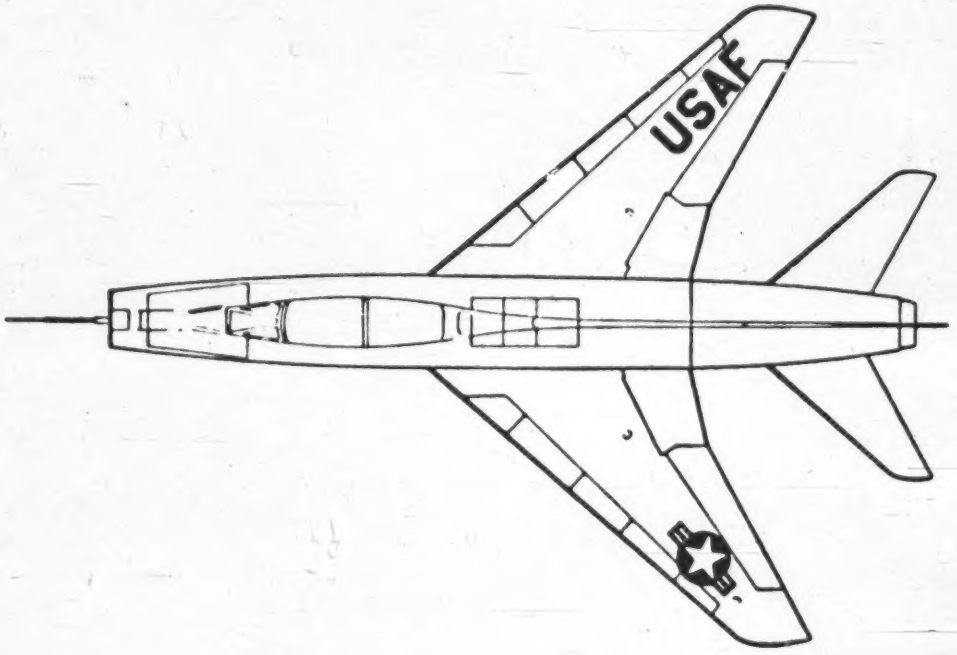
FIGHTER-BOMBER



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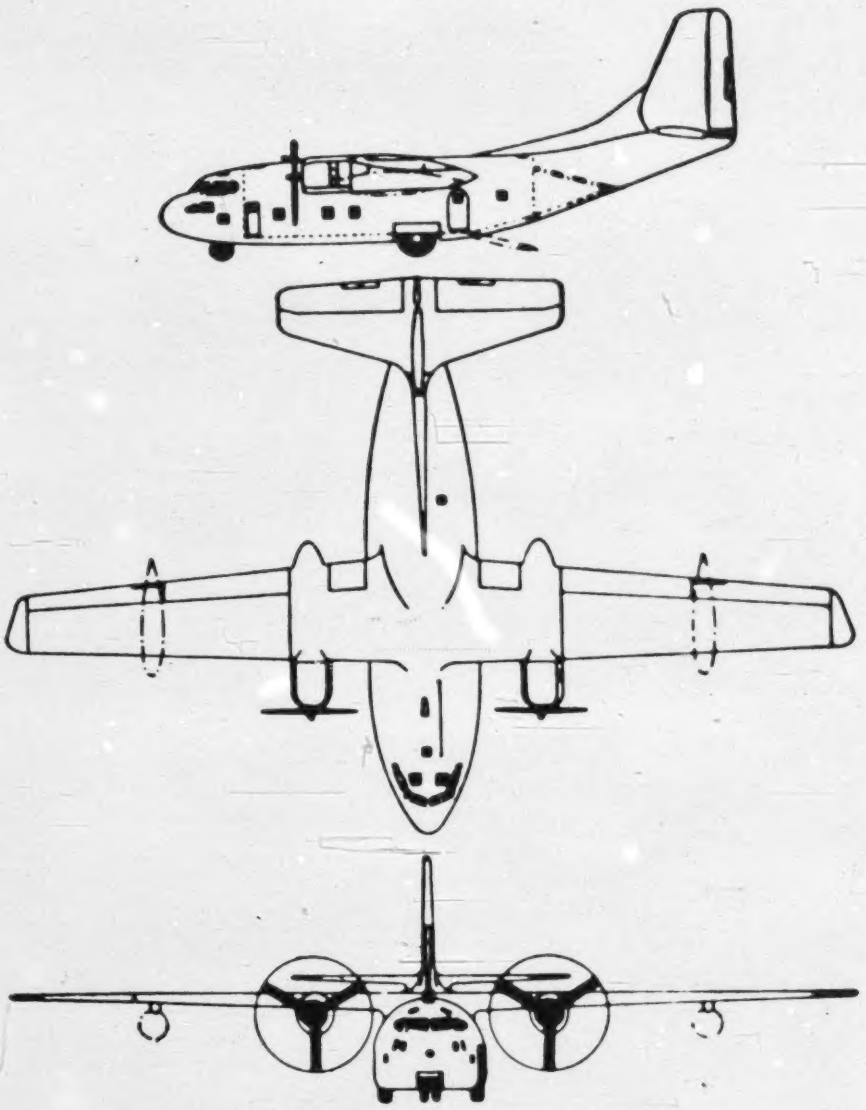
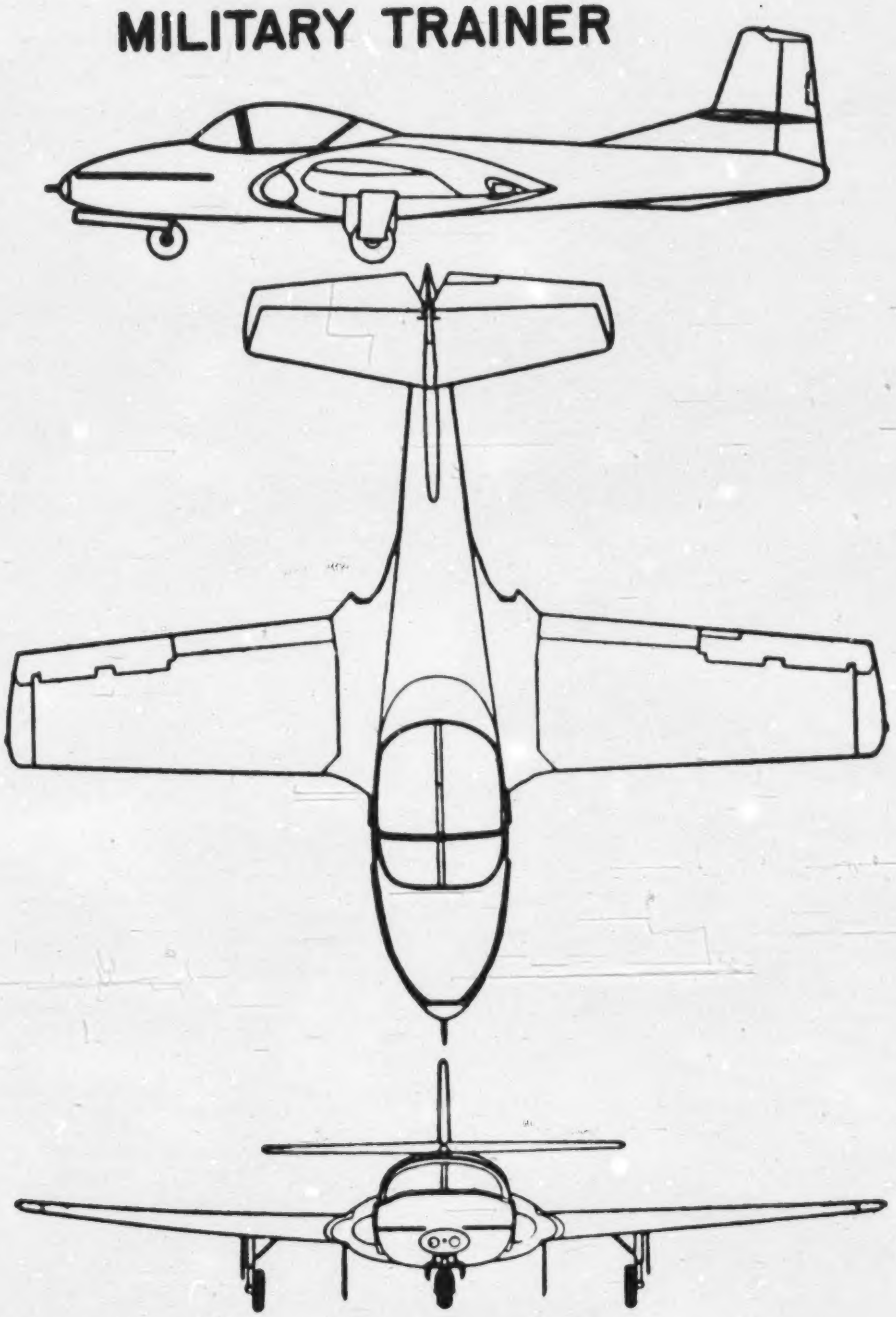
MILITARY CARGO



MILITARY TRAINER



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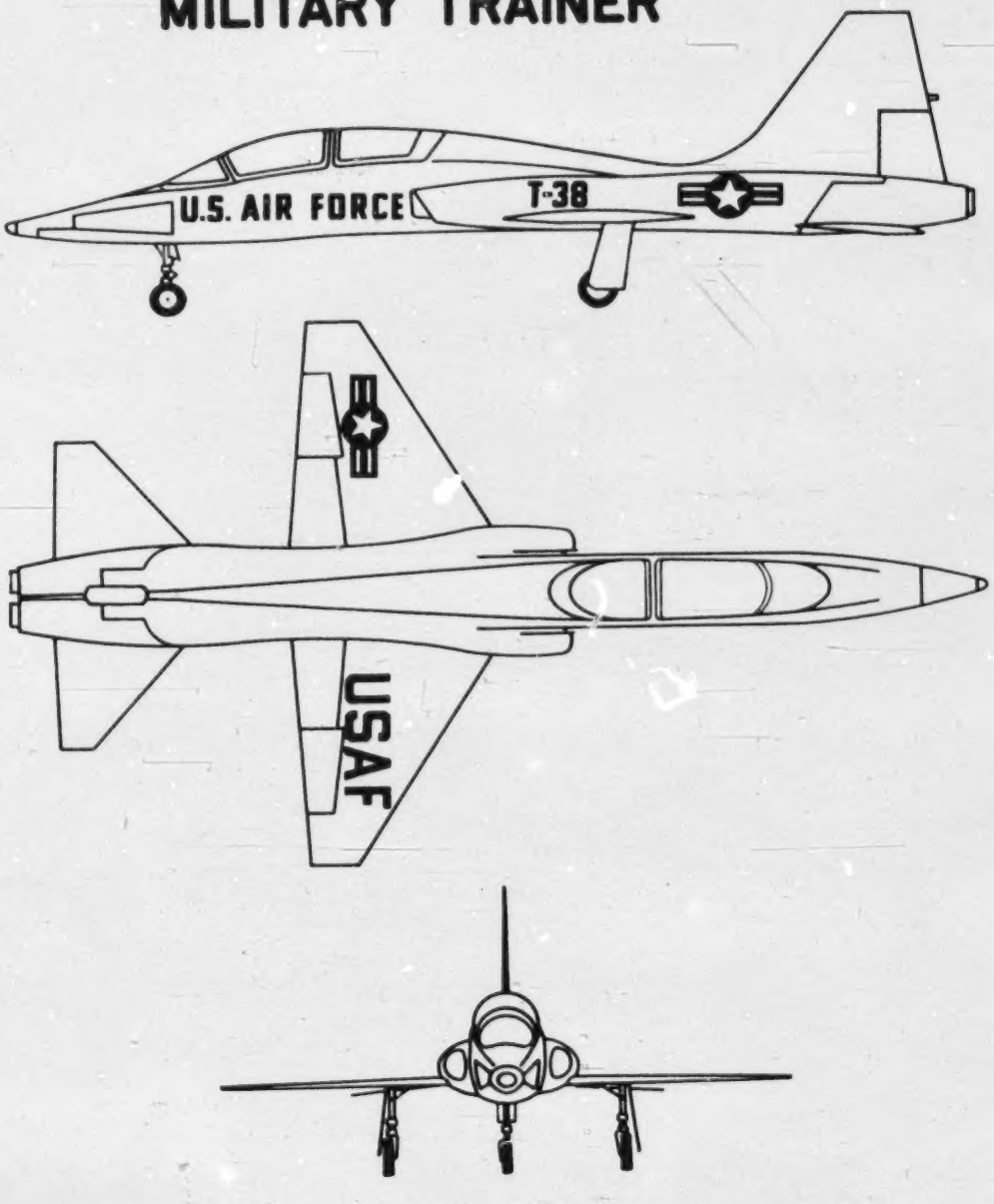

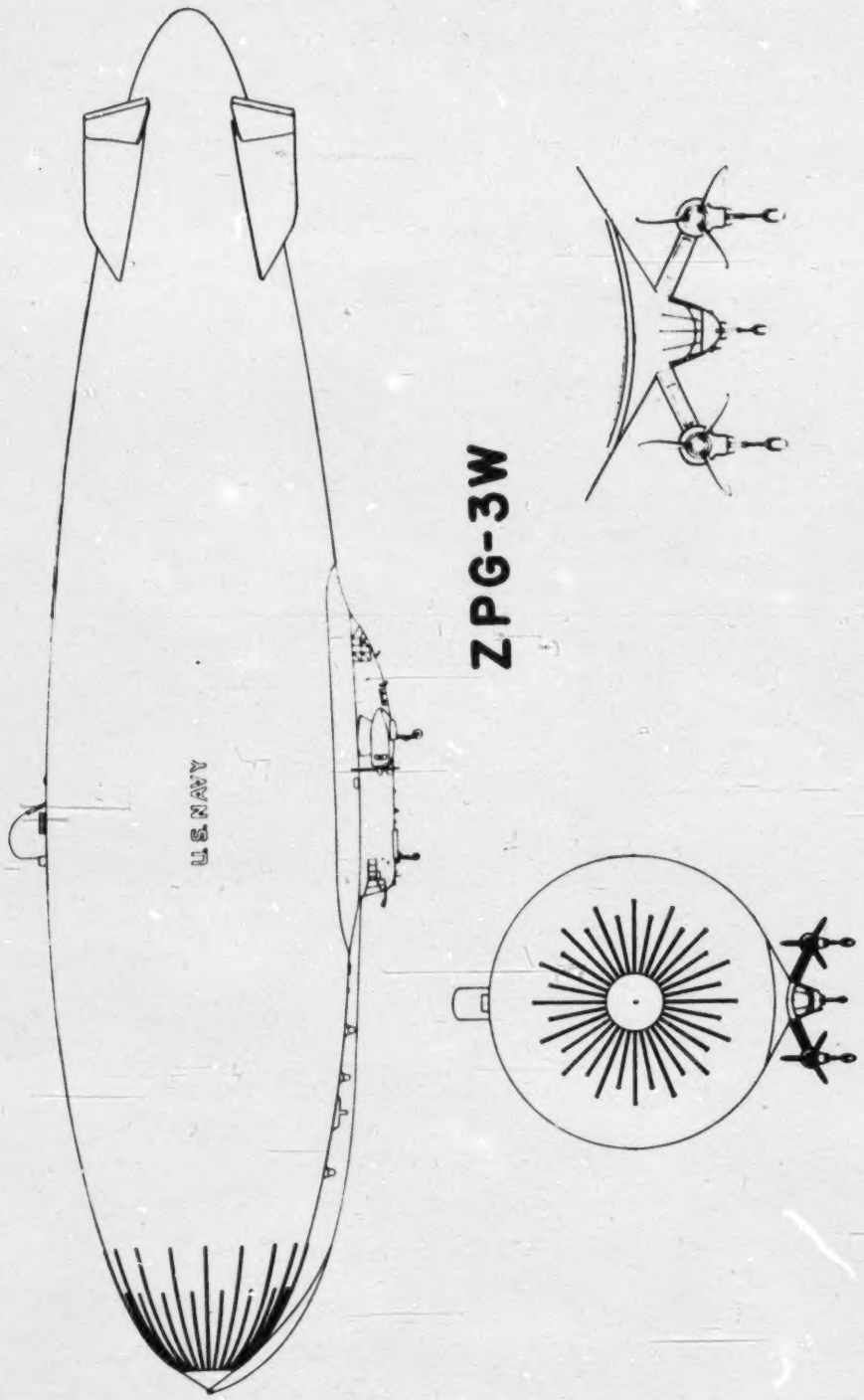

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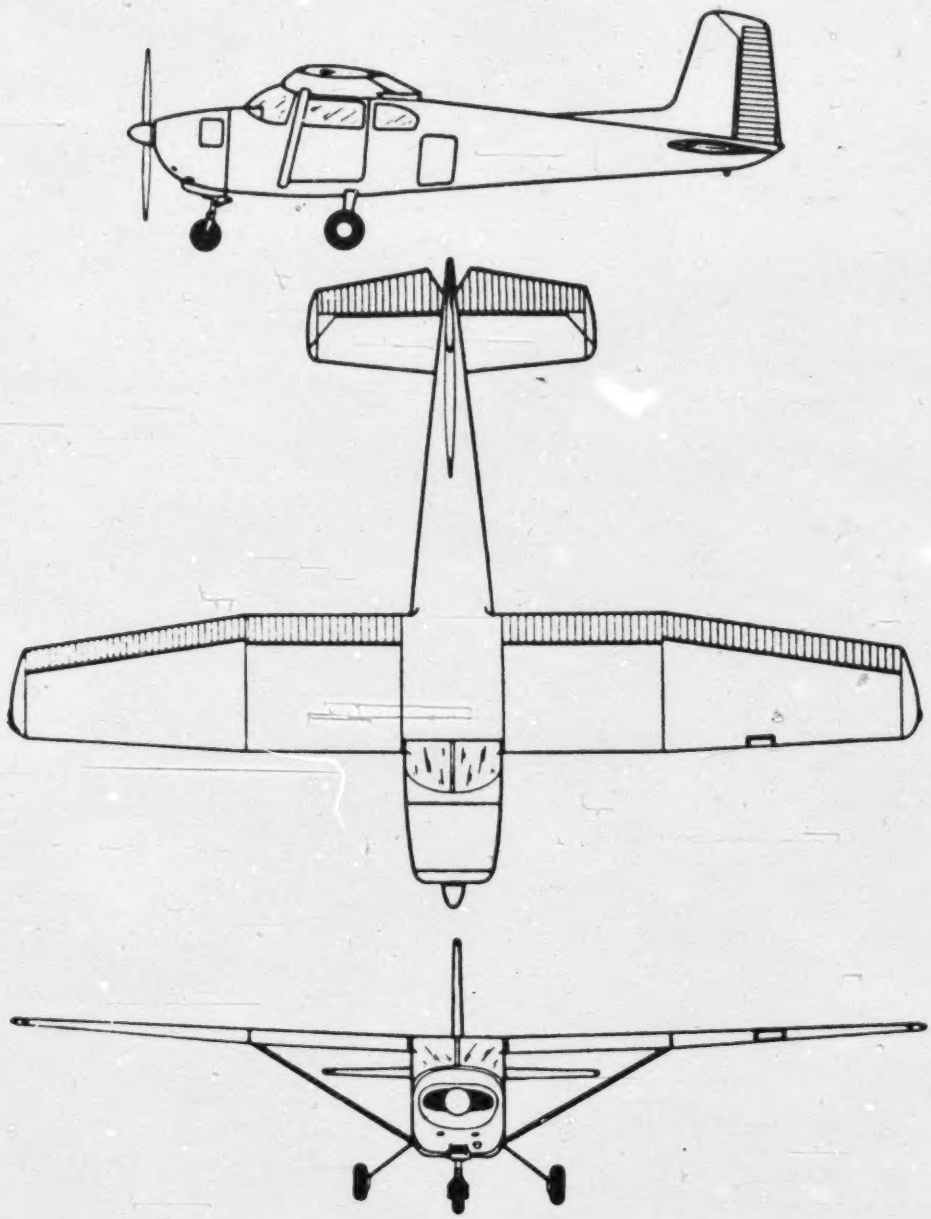
PRIVATE COMMUTER



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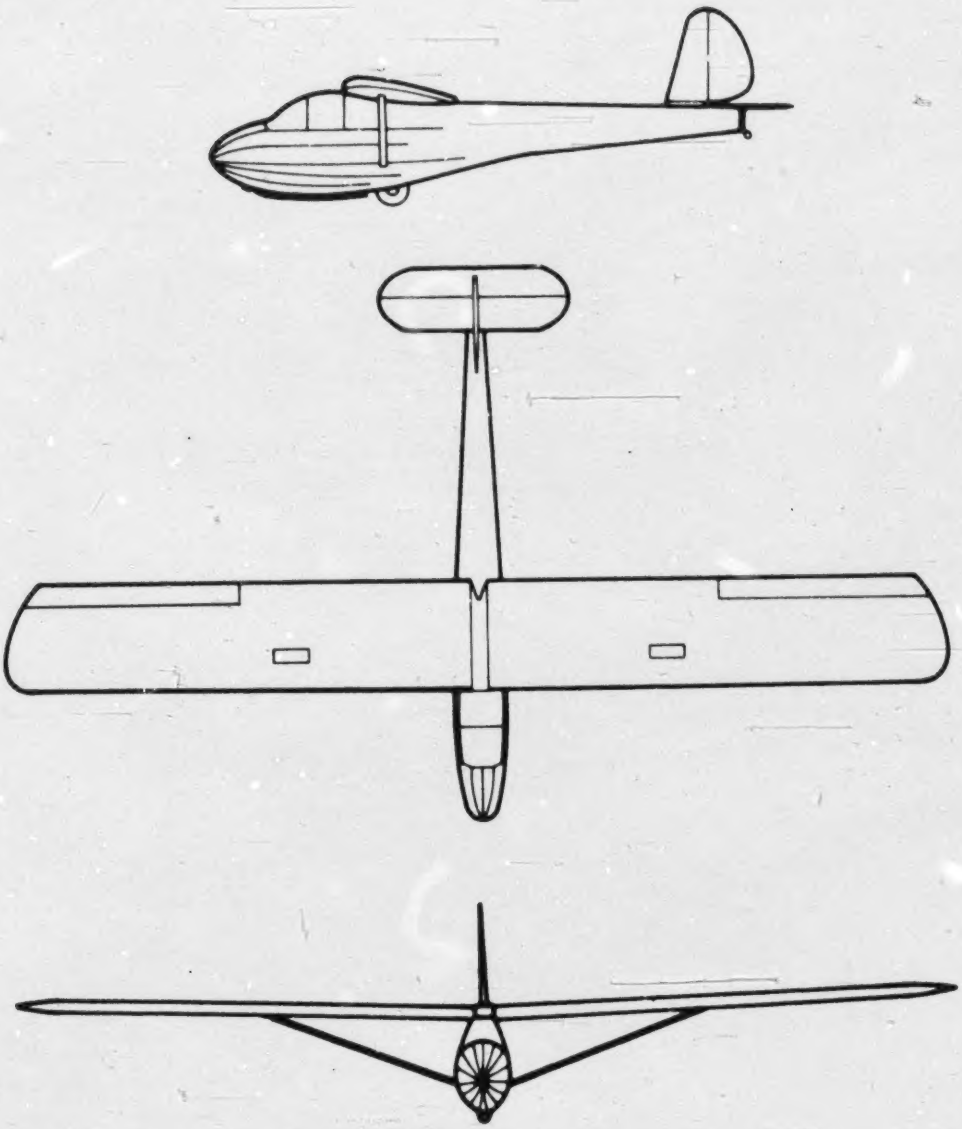
SAILPLANE



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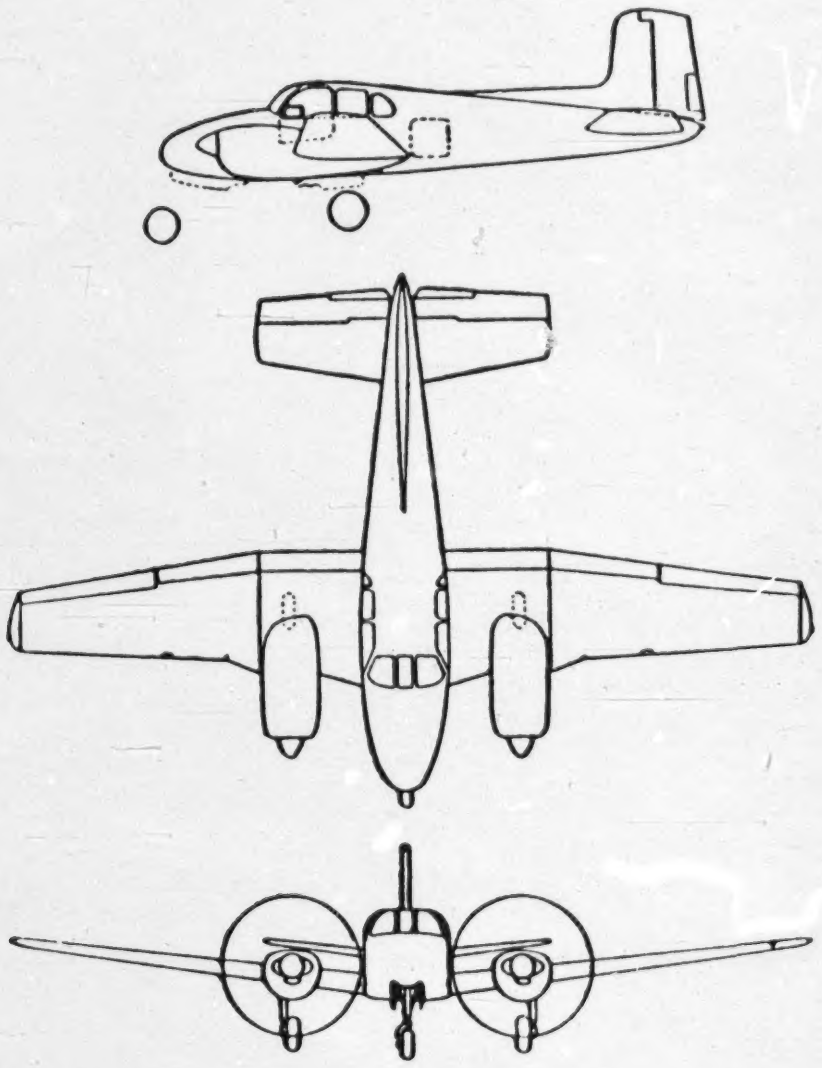
SIX PASSENGER EXECUTIVE TRANSPORT



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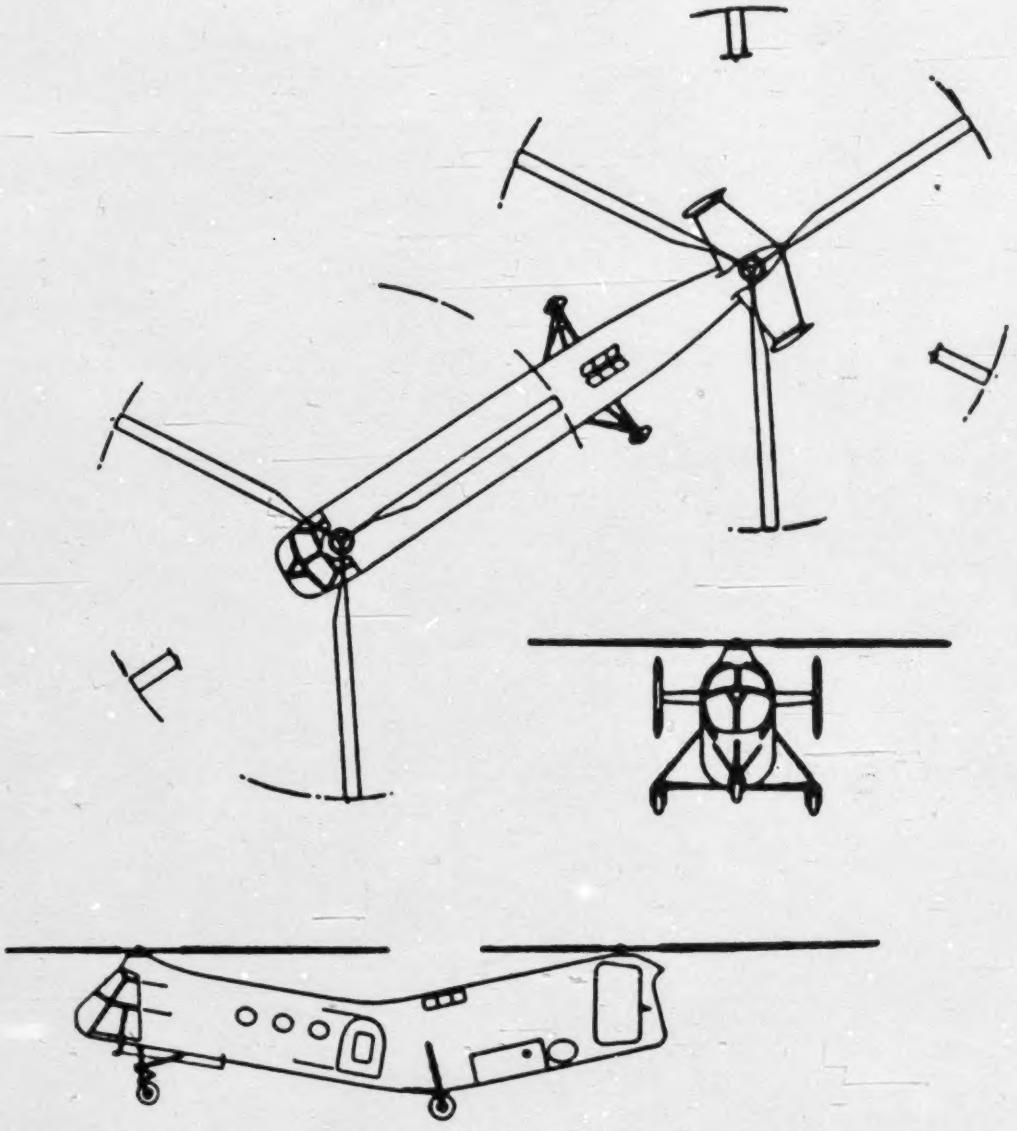
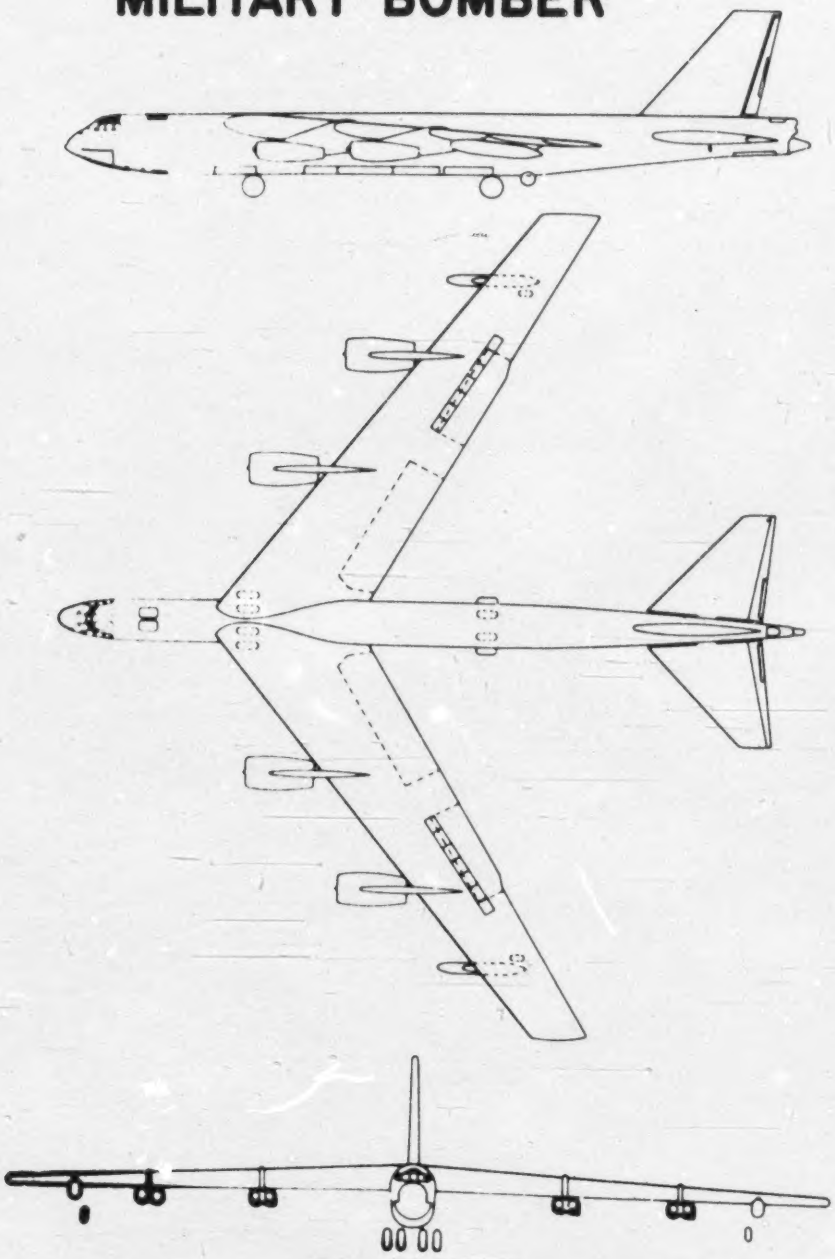
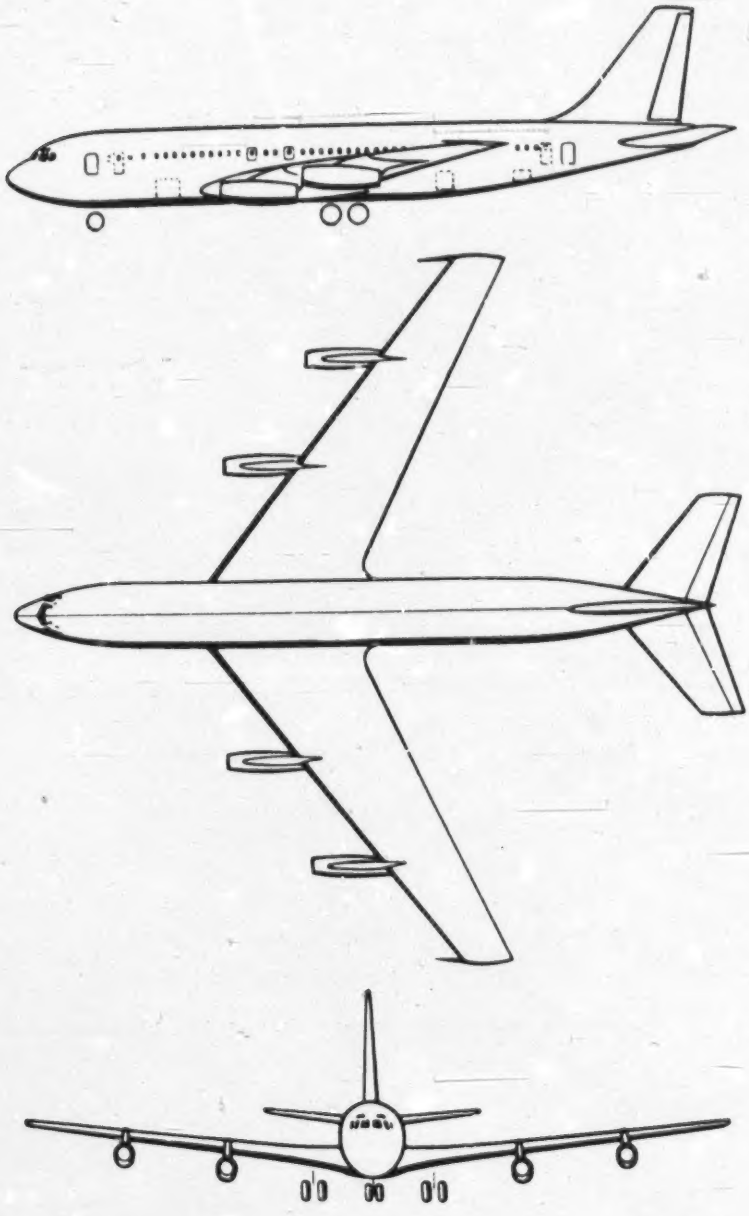
TRANSPORT HELICOPTER



MILITARY BOMBER

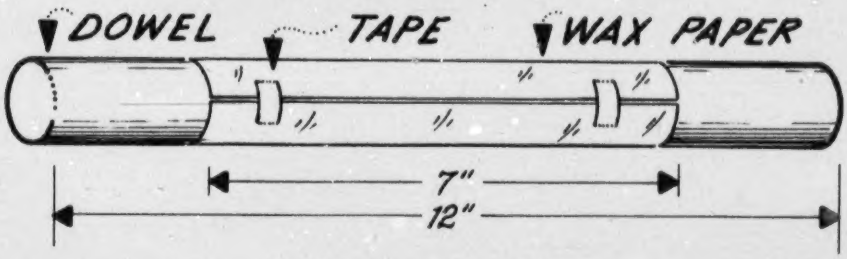


JET TRANSPORT



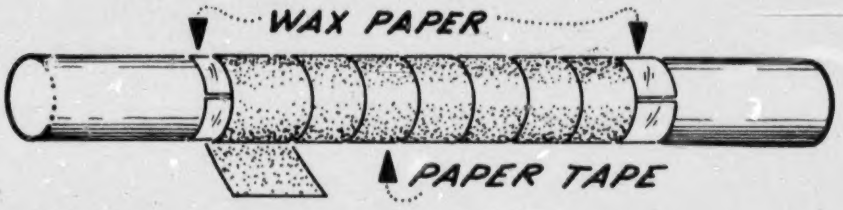
CONSTRUCTING ROCKET BODY

Step 1. Wrap 3 layers of wax paper to cover about 7 inches of length on a 1/2" diameter X 12" dowel rod. Secure the wax paper with small pieces of plastic or masking tape.



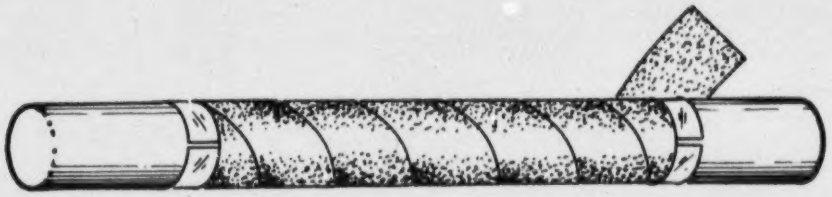
Step 2. Wrap one layer of 1" wide mucilage-backed paper tape, properly moistened, straight-wrapped over wax paper.

Note: To avoid having paper tape adhere to dowel rod, do not extend beyond ends of wax paper.



Step 3. After the paper tape has "set up" (about 50 to 75% dry), wrap a second layer, using a bias pattern.

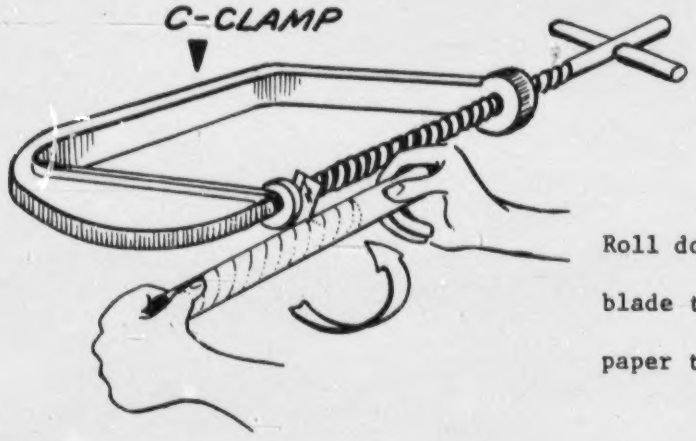
Step 4. After the second layer of paper tape is about 75% dry, wrap a third layer on a bias pattern, starting at the end where the second layer stopped.



Step 5. After final layer of paper tape has dried, remove dowel rod from rocket casing (body). Remove excess wax paper from inside of rocket body, being careful not to damage the body itself.

Step 6. Trim the length of the rocket body to 6" long. Sharp scissors will square the ends. Some may find it convenient to cut the rocket body to length before removing it from the dowel. This can be accomplished by rolling it against a stationary razor blade.

CAUTION: Use sharpened cutting tools with extreme care.



Roll dowel against razor blade to square ends of paper tube.

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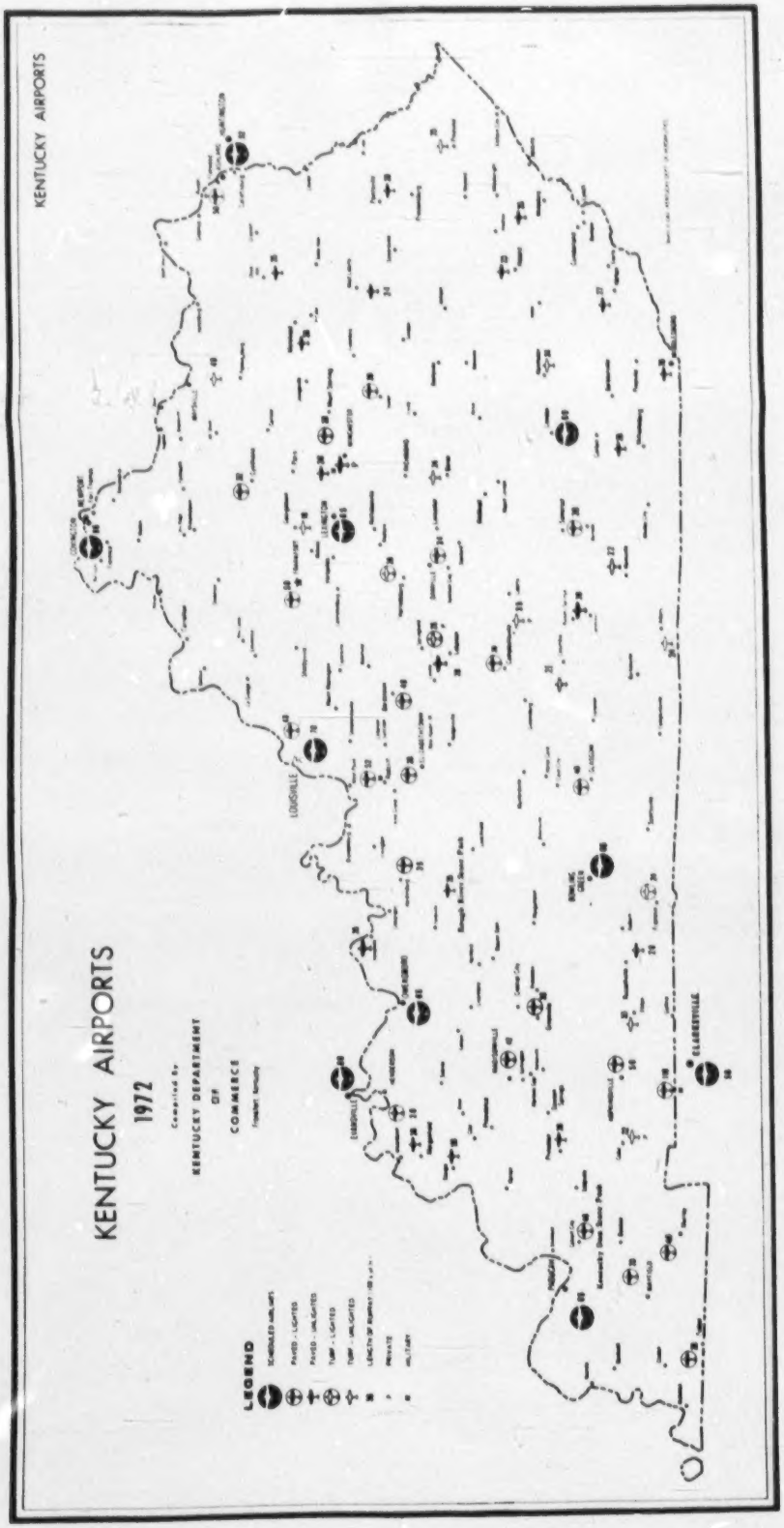

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"Industrial Resources - Kentucky"
Kentucky Department of Commerce, 1972

UNIT FIVE

INTRODUCTION TO THE EXPLORATION

OF

OCCUPATIONS IN CONVEYANCE SYSTEMS OF TRANSPORTATION

UNIT PURPOSE: To explore, in depth, background information and occupational opportunities in conveyance systems transportation

PERFORMANCE OBJECTIVES: The student will be able to

I. Describe conveyance transportation and analyze its importance to the economy.

II. Identify and discuss the occupational opportuniites in conveyance transportation.

III. Examine the employment trends and necessary skills outlook in conveyance transportation.

IV. Describe, in depth, at least two conveyance transportation jobs.

I. The student will be able to describe conveyance transportation and analyze its importance to the economy.

A. Suggested Content

1. Conveyance systems must be analyzed according to what is being transported

a. Matter

(1) Types of materials

--Liquids

-Oil
-Gasoline
-Water
-Chemicals
-Milk

--Gases

-Natural gases to burn for energy
-Forced hot air for heating
-Superheated steam for generating electricity
-Oxygen

--Solids

-Coal
-Assembly line products
-Distribution of products

(2) Means of material conveyance

--Pipelines
--Metal duct work

-For distribution of warm and cool air (climate control)

--Conveyor systems

-Overhead carrousel
-Overhead monorail
-Gravity operated roller
-Gravity operated skatewheel
-Power operated slat
-Gravity operated portable belt
-Power operated belt

-- Troughs

b. Means of moving people

(1) Recreational

--Chair lifts
--Rope tows
--Cable cars

(2) Business and Commercial

--Elevators
--Escalators
--Conveyor belts (moving sidewalks)

c. Movement of energy

(1) Electricity

--Electrical wires
--Electrons flow through conductors

(2) Sound

--Sound waves
--Wires

(3) Light

--Light waves
--Laser beams

2. Transporting materials by pipeline is an important phase of transportation.

a. The most obvious example of this method of moving material is the vast system of oil pipeline.

(1) More oil is moved through pipelines than by any other method.
(2) In the United States and Canada, about a million miles of pipeline moves gas, crude oil and petroleum products under rivers, through hills and valleys and over mountains.
(3) Pipelines carry crude oil from fields to refineries and many petroleum products to markets and distribution areas.
(4) Several types of fuels and petroleum products may move through the same pipelines at one time.

(5) The first pipelines in the United States were constructed from logs hollowed by boring through the length. About 500 B.C., the Chinese used bamboo shafts to pipe natural gas.

b. Every American is aware of pipeline transportation because of the extensive household plumbing.

(1) Pipelines bring clean water into the home.
(2) Pipelines are used to transport wastes.

--Maintain sanitary standards of living

c. Pipelines are constructed from several kinds of materials. This provides jobs in supportive industries.

(1) Steel
(2) Cast iron
(3) Aluminum
(4) Copper
(5) Ceramics
(6) Plastics
(7) Concrete
(8) Fibers

d. Many materials and products are transported through pipelines.

(1) Natural gas
(2) Manufactured gas
(3) Chemicals
(4) Water
(5) Coal (granulated in a water slush)
(6) Fertilizers

e. Pipelines are used to carry materials for service, manufacturing and agricultural purposes.

(1) Public service uses

--Sewer lines
--Sewage treatment
--Water lines
--Fuel lines
--Steam lines

(2) Manufacturing uses

--In-plant distribution systems
--Product-blending systems
--Lubrication systems
--Power systems
--Product-packaging systems
--Waste-disposal systems

(3) Agricultural uses

--Irrigation systems
--Fertilizer systems
--Waste-disposal systems
--Drainage systems

3. Conveyances of many designs are used to move materials, products and people.

a. Belts (power driven from pulley to pulley) are widely used. Some examples are as follows:

(1) Moving ore from mines
(2) Moving coal for loading
(3) Moving cartons in freight terminals
(4) Moving parts for assembly
(5) Moving people and baggage in air terminals and shopping plazas (moving sidewalks, etc.)
(6) Inclined belts for changing elevation

--Escalators
--Moving ramps (powered inclines)
--Vertical-use conveyor belts

b. Portable units for moving goods

(1) Platform trucks
(2) Forklift trucks (storage battery or internal combustion power)

--Operator-ride type
--Operator-walk type

(3) Pallet-lift trucks (land powered)
(4) Bin trucks
(5) Two-wheel hand trucks
(6) Tractor trailer units with wheeled dollies
(7) Gravity operated rollers
(8) Skatewheel units

c. Installed units (fixed systems)

(1) Continuous drive transfer loaders

--Warehouse and freight terminal systems
--Mining and excavating applications
--Loading and unloading railroad cars, trucks and boats

(2) Assembly line riggings
(3) Overhead hook or bin conveyors
(4) Vacuum tubes for delivery of small parts and messages

d. Conveyance units driven by cables and pulleys

(1) Cranes and hoists
(2) Freight and service elevators
(3) Building elevators
(4) Chair lifts
(5) Cable cars

B. Suggested Teaching-Learning Activities

1. Visit a pipeline construction site and prepare a list of required jobs by observing the ongoing activities. See "Pipeline Construction," p. 234.

2. Ask a welding instructor from the vocational school to lead a class discussion concerning careers in pipeline construction.

3. Construct a model pipeline in the classroom to demonstrate how materials can be transported by this method.

   a. Use sections of clear plastic tubing to view the flow of liquids.

   b. Gravity will provide flow from slightly elevated reservoirs.

   c. Water colored with food coloring can be used as materials.

4. Prepare a map of the U.S. and Canada and draw in natural gas and crude oil and petroleum product pipelines, using different colors to distinguish each. See "Pipelines Map," p. 235.

   Note: Most commercial maps distinguish between gas and oil pipelines only.

5. Visit a large or medium-sized post office to observe the types of conveyance systems in use.

6. Construct a conveyance system to move items from one point in the classroom or laboratory to another.

   a. Ropes and string can be used as cables.

   b. Spools can serve as pulleys.

   c. Wide rubber bands will function as conveyor belts.

   d. Bins can be fabricated from construction paper.

7. Ask a freight terminal manager to lead a class discussion concerning the operation of a terminal.

8. Visit a modern warehouse. Identify methods of conveyance. See "A Carrousel Conveyance System," p. 236, "Types of Conveyors," p. 237, and "Warehouse Transportation," p. 238.

9. Construct the "telephone" by stretching a thin wire tauntly between two tin cans. The sounds received at one end after the other can has been spoken into are sound waves that have been transported along the wire.

10. Develop a manufacturing flow chart to show how materials move from the suppliers, through the complete production process, to packaging, warehousing and shipping preparation.

11. Assign a class team to inventory classroom and laboratory equipment and supplies, and report their procedures to the class.

12. Correspond with manufacturing and transportation companies to obtain charts and booklets describing systems and equipment used for moving goods, products and people.

C. Suggested Evaluation

1. Have students write reports describing the concepts that they have acquired related to this unit of transportation.

2. Through class discussion, attempt to determine if student awareness has been increased in this often ignored category of transportation systems.

D. Suggested Resources

1. Books

a. Materials Handling

b. Orientation and Craft Skill Training

2. Booklets

a. "Atlantic Richfield Company"

b. "The Chicago Refinery"

c. "Creative Packaging"

d. "Conserving Our Wildlife"

e. "Exxon U.S.A."

f. "Going Places in Oil"

g. "Humble Today"

h. "Kaiser Engineers"

i. "Oil and Environment: The Challenge of Our Times"

j. "Petroleum and the Environment"

k. "Petroleum Marketing"

l. "Reynolds Aluminum in Material Handling"

m. "Solid Set Irrigation"

n. "The Story of Oil"

o. "This is Atlantic Richfield"

3. Pamphlets

a. "A Few (kind) Words About Paperbound Packaging"

b. "Drainage Pipe"

c. "Oil Country Pipe"

d. "Packaging and the Pollution Problem"

e. "Reynolds Aluminum Irrigation Pipe"

4. Resource Persons

a. Freight terminal manager

b. Vocational school welding instructor

5. Transparency Masters

a. "A Carrousel Conveyor System," p. 236

b. "Pipeline Construction," p. 234

c. "Types of Conveyors," p. 237

d. "Warehouse Transportation," p. 238

II. The student will be able to identify and discuss the occupational opportunities in conveyance transportation.

A. Suggested Content

1. Careers Relating to the manufacture or construction of conveyance devices are similar to those represented in other areas of transportation.

2. Oil pipeline activities require a wide range of skills that are represented in several occupational categories. The following list gives examples of directly involved and related categories.

a. Engineering

b. Geology

c. Physics

d. Chemistry

e. Construction

f. Research

g. Ecology

h. Law

i. Transportation

k. Marketing and finance

3. The American Petroleum Institute lists 37 career opportunities directly necessary to pipeline transportation. Some of them are as follows:

a. Aircraft patrol pilot

b. Chemist

c. Carpenter foreman

d. Chief delivery man

e. Connection foreman

f. Corrosion engineer

g. Gager

h. Lineman

i. Mechanical engineer

j. Operator

k. Pipeline construction inspector

l. Shop foreman

m. Terminal employees

n. Weldor

o. Work equipment operator

4. Occupational implications for the conveyor related grouping of transportation topics are represented by a typical array of technical and functional categories.

a. Equipment design and engineering

b. Equipment manufacturing

c. Systems engineering

d. Marketing

e. Installation

f. Maintenance

g. Quality control

h. Packaging

i. Warehousing

j. Management

k. Dispatching

l. Accounting

m. Insurance

n. Leasing

o. Contracting

p. Security

q. Clerical

r. Communications

s. Construction

t. Traffic

5. Occupations that relate to conveyance devices that are for the direct service of people are broad in scope.

a. Architects

b. Engineers

c. Designers

d. Construction personnel

e. Safety experts

f. Psychologists

6. Occupations that relate to the transportation of energy are of a technical nature.

a. Electrical engineers

b. Electrical line workers

c. Power station personnel

--Watch engineers
--Switchboard operators

d. Load dispatchers

e. Meter readers

B. Suggested Teaching-Learning Activities

1. Have the students compile a list of all the occupations of which they are directly aware which have to do with conveyance transportation.

2. Arrange a tour of an electric power generating plant or sub-station.

3. Arrange for a plumber or an electrician to visit the classroom and talk about his occupation.

4. Have the students prepare a chart categorizing occupations relating to the many facets of conveyance transportation.

C. Suggested Evaluation

1. Have students prepare a listing of occupations representative of the necessary functional and technical categories required in this area of transportation.

D. Suggested Resources

1. Books

   a. Materials Handling: Traffic and Transportation

   b. Occupations and Careers

   c. Occupational Outlook Handbook

2. Booklets

   a. "Careers in the Oil Industry"

   b. "Finding Your Place at Atlantic Richfield"

   c. "Kaiser Aluminum Technical Information"

   d. "Reynolds Aluminum in Material Handling"

   e. "Your Career"

3. Films

   a. "Sea Robin"

   b. "Slochteren On the Line"

   c. "The Trans-Alpine Pipeline"

4. Pamphlets

   a. "Careers for High School Graduates at International Harvester Company"

   b. "Marketing"

5. Resource Persons

   a. Electrician

   b. Plumber

III. The student will be able to examine the employment trends and necessary skills outlook in conveyance transportation.

A. Suggested Content

1. There is a tendency for the number of persons employed in conveyance transportation to remain unchanged.

   a. Once the construction of the conveyance device is completed, the only personnel needed are maintenance and control.

   b. Expansion of manufacturing and industry causes expansion of conveyance transportation.

   c. Some job openings arise each year to replace employees who quit, retire, or die.

2. The new oil pipeline to Alaska, if approved and implemented, will provide thousands of new jobs.

3. Pipeline conveyance accounts for 23% of all freight transportation volume.

4. The projected annual rate of increase in pipeline transportation freight volume is:

   a. 6% through 1975

   b. 5 1/2% through 1980

5. Population expansion may require new and improved conveyance methods of moving people.

6. Employment in the electric power industry is expected to remain stable.

   a. Usage of electricity will increase.

   b. The increase will be offset by improved automatic controls.

NOTE: The teacher should refer to some of the investigative questions that are presented in the previous units. These questions will help the students to gain some insight into the employment trends and outlooks.

B. Suggested Teaching-Learning Activities

1. Involve the students in a discussion of how they believe conveyance transportation of people might operate in the future.

   a. Could it be used in conjunction with other systems?

(1) Conveyors on super highways?
(2) Mass transportation?

2. Determine which industries in the area are involved with any form of conveyance transportation. Contact these industries to determine from them the net change in personnel numbers in the last ten years.

   a. In which areas were these changes made?

   b. Is there any planned expansion?

3. Determine what, if any, new construction is planned that would increase employment in conveyance transportation in the area.

4. Have a person involved in conveyance transportation discuss with the students the employment outlook.

C. Suggested Evaluation

1. Have the students project what changes in conveyance transportation jobs they anticipate transpiring in the 1980's.

D. Suggested Resources

1. Books

   a. Occupation Outlook Handbook

2. Booklet

   a. "Guide to Federal Career Literature"

3. Pamphlet

   a. "Employment Outlook for Industrial Traffic Managers, Purchasing Agents"

4. Resource Person

   a. Traffic manager of assembly plant

IV. The student will be able to describe, in depth, at least two conveyance transportation jobs.

A. Suggested Content

1. Plumber and pipefitter

a. Earnings

(1) Varying earnings according to locale
(2) Average union hourly wage rates

--Plumbers - $7.01
--Pipefitters - $6.93

(3) Minimum union hourly wage range

--$5.00 - Norfolk, Virginia
--$9.42 - Oakland, California
--$415.00/month - State employees in Kentucky

b. Job characteristics and duties

(1) Install pipe systems to carry

--Water or other liquids
--Steam
--Air or other gases

(2) Install plumbing fixtures, appliances, heating and refrigerating units
(3) Alter and repair existing pipe systems

--Unclog drains and pipes
--Replace faucets and faucet washers
--Measure, cut and thread pipe
--Cut openings in walls, floors, etc., to expose pipes and fittings
--Join pipes with screws, solder, bolts, and various fittings
--Replace diaphragm and flush valve in commodes

c. Plumbers distinguished from pipe fitters by the type of work being done.

(1) Plumbers

--Work on water, gas and waste disposal systems, especially those connected with public utility systems
--Install heating and air conditioning units
--Connect radiators, water heaters, and plumbing fixtures, such as bathtubs and sinks

(2) Pipefitters

--Install high and low pressure pipes that carry hot water, steam and other gases
--Install ammonia carrying pipelines in refrigeration plants
--Install complex pipe systems in oil refineries and chemical food processing plants

(3) Some plumbers and pipefitters specialize as gas fitters or steamfitters

d. Educational requirements

(1) Ability to read and write
(2) Service in apprenticeship program
(3) Knowledge of related subjects

--Blueprint reading
--Mathematics

e. Special knowledge, skills and ability requirements

(1) Thorough knowledge of tools and materials used in the trade

--Wrenches
--Reamers
--Drills
--Braces and bits
--Hammers
--Chisels
--Saws
--Pipe cutters
--Pipe threaders
--Hydraulic pipe benders
--Gas or acetylene torches and welding, soldering and brazing equipment

(2) Thorough knowledge of the skills needed for installation of pipe

--Bending
--Welding
--Caulking
--Soldering
--Threading
--Testing under pressure for leaks

f. Employment outlook

(1) In 1970, 350,000 plumbers and pipefitters employed
(2) The numbers needed are expected to rise rapidly during the 1970's.

--Construction activity is expected to increase.
--Trend toward more bathrooms per dwelling unit is expected to continue.
--Additional appliances for each home will continue.

(3) The economic recession may have a short range adverse effect on the growth of the plumbing industry.

2. Roustabout

a. Employed as a helper to a pumper in the petroleum and natural gas production industry

b. Employment outlook

(1) Employment in all mining operations is expected to decline slowly despite increases in output.

--Improved equipment
--More highly skilled work forces

(2) Diminishing world oil resources may force the discovery of new and less expensive sources of energy.

c. Earnings

(1) Average $145.00/week

d. Job characteristics and duties

(1) Helps operate and maintain motors, pumps and other equipment needed to force the artificial flow of oil from wells
(2) Helps to regulate the flow of oil according to a schedule set up by the petroleum engineer and production foreman

e. Advancement possibilities

(1) New inexperienced worker
(2) May advance through the ranks in the following order

--Roustabout
--Pumper, switcher, or gager
--Petroleum engineering aide (usually people with 2-year technical degrees)

3. Industrial Traffic Manager

a. Arrange transportation of raw materials and finished products for industrial firms

(1) May involve all forms or combinations of transportation

--Rail
--Air
--Road
--Water
--Conveyance

(2) Must consider economics, efficiency and time scheduling of the operations

b. Earnings

(1) Vary according to experience, responsibility, sales volume and transportation costs
(2) Beginners with college degrees

--$8,000 per year

(3) Average salaries with companies whose transportation costs are less than $1 million annually

--$15,000 per year

(4) Salaries in companies with transportation costs averaging between $4 million and $10 million

--$25,000 to $30,000 per year

(5) Salaries in some firms with higher than $10 million transportation costs

--$40,000 or more per year

c. Job characteristics and duties

(1) Route and trace shipments

--Arrange with carriers for transportation service
--Prepare bills of lading and other shipping documents
--Determine the types and arrangements of conveyance methods to be used within a plant
--Handle claims for lost or damaged goods
--Must be aware of changing transportation concepts
--Must know federal, state, and local government regulations and other legal matters which apply to shipping operations

d. Educational requirements

(1) High school graduate may be able to qualify

--Based on work experience in traffic department

(2) College education is becoming increasingly important.

--Needed to argue cases before the U.S. Interstate Commerce Commission
--Prefer courses in transportation, management, economics, statistics, marketing, commercial law

e. Employment outlook

(1) Moderate increase is expected through the 1970's.

--Reorganization of shipping and receiving into separate departments will double jobs.
--Greater distances of travels for raw materials and finished products will require greater planning.
--Costs variations in shipping will mean companies will be more interested in economies and efficiency.

B. Suggested Teaching-Learning Activities

1. Assemble a class reference notebook containing several occupational outlines.

2. Students will be supplied with several lengths of galvanized pipe and assorted elbows, T's and Y couplings. Using appropriate tools, they will be permitted to "create" something, (junk sculpture) from the supplies by cutting, threading and coupling pieces. Invite a plumber to assist with instruction in the use of the tools.

3. The teacher could devise a game whereby it is necessary to transport an item or items from one point in the room to another. There will be alternate routes, some more expensive than others, some faster than others. Some routes might require the installation of conveyance methods. The students will act as traffic managers and devise the best route which conforms with the guideline requirements. This game might also be only an hypothetical situation on paper.

4. Students should research the following occupations: maintenance electrician, switchboard operator, load dispatcher, meter reader, derrickman, and oil flow switchers. The student should be able to describe these occupations and outline the responsibilities.

C. Suggested Evaluation

1. Have each student select an occupation of his choice and do an in-depth analysis of that occupation.

D. Suggested Resources

1. Books

a. Occupations and Careers

b. Occupational Outlook Handbook

c. Department of Transportation

2. Booklets

a. "Careers in the Oil Industry"

b. "Your Career"

3. Films

a. "Men, Mountains, and Mind"

b. "Pipeline People"

c. "Roughnecks"

SUPPORTIVE MATERIALS

FOR

UNIT FIVE

REFERENCE LIST FOR UNIT FIVE

BOOKS

1. Department of Transportation
   Superintendent of Documents

2. Materials Handling: Traffic and Transportation Tyler and Corenthal, McGraw Hill Inc.

3. Occupational Outlook Handbook United States Government Printing Office

4. Occupations and Careers by Feingold and Swerdloff, Webster Division, McGraw-Hill Book Company

5. Orientation and Craft Skill Training Post Office Department Washington, D.C.

BOOKLETS

1. "Atlantic Richfield Company," Atlantic Richfield Company

2. "Careers in the Oil Industry," American Petroleum Institute

3. "The Chicago Refinery," Union Oil Company of California

4. "Conserving Our Wildlife," Standard Oil Company of California

5. "Creative Packaging," Kaiser Aluminum Foil and Container Division

6. "Exxon USA," A Division of Exxon Corporation

7. "Facts About Oil," American Petroleum Institute

8. "Find Your Place at Atlantic Richfield," Atlantic Richfield

9. "Going Places In Oil," American Petroleum Institute

10. "Guide to Federal Career Literature," United States Civil Service Commission, U.S. Government Printing Office

11. "Humble Today," Humble Oil and Refining Company

12. "Kaiser Aluminum Technical Information," Kaiser Aluminum and Chemical Sales, Inc.

13. "Kaiser Engineers," Kaiser Aluminum and Chemical Sales Inc.

14. "Mark Steel Fights Pollution!," Public Relation Department, American Iron and Steel Institute

15. "Oil," Standard Oil Company of California, Public Relations Department

16. "Oil and Environment: The Challenges of Our Times," American Petroleum Institute, Washington

17. "The One-Leaf-Book Story of Environment and Industry," Education Services, United States Steel Corporation

18. "Petroleum and the Environment--The Life Around Us," Union Oil Company of California

19. "Petroleum Marketing," American Petroleum Institute, Division of Marketing

20. "Reynolds Aluminum in Materials Handling," Reynolds Metals Company

21. "Solid-Set Irrigation," Reynolds Metals Company

22. "The Story of Gasoline," Ethyl Corporation, Petroleum Institute

23. "The Story of Oil," Standard Oil Company of California, Public Relations Department

24. "This is Atlantic Richfield," Atlantic Richfield

25. "Your Career," Union Oil Company of California

CATALOGS

1. "American Petroleum Institute," American Petroleum Institute

2. "Bureau of Mines - Films," U.S. Department of the Interior, Bureau of Mines

3. "Checklist of On-the-Job Training, Experiences for Service Station Employees," American Petroleum Institute

4. "Driver Selection and Training Guide, 1960," American Petroleum Institute

5. "Promotional Aids - Instructional Materials for Service Station and Petroleum Marketing Employees, 1967," American Petroleum Institute

CHARTS

1. "Chemistry of Petroleum Refining," American Petroleum Institute

2. "Economic Growth and How It Is Measured," American Petroleum Institute

3. "Tire Manufacturing Flow Chart," B.F. Goodrich

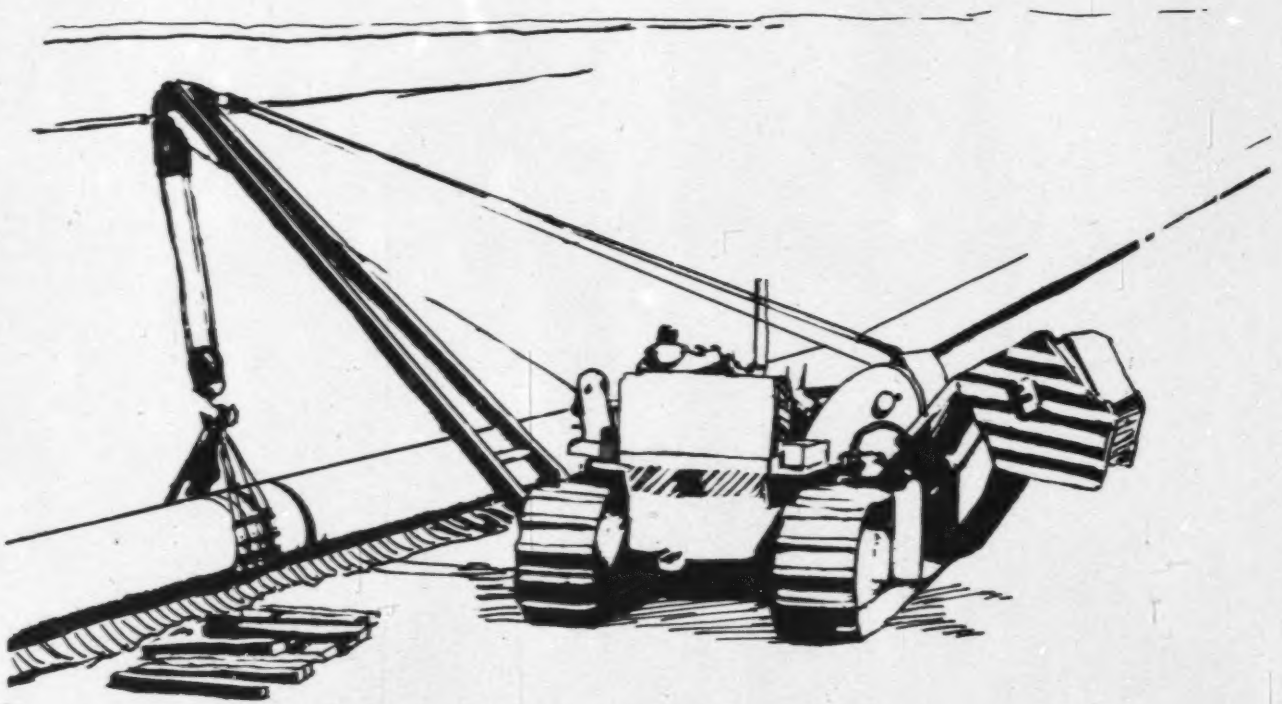
FILMS

1. "Men, Mountains, and Mud," (S-917) 16mm, Association-Sterling Films, 1970
2. "Pipeline People," 16mm, American Gas Association, 1968
3. "Roughnecks," 16mm, Canadian Petroleum Association, 1960
4. "Sea Robin," 16mm, United Gas Pipeline Company
5. "Slochteren On The Line," 16mm, The Royal Netherlands Embassy
6. "The Trans-Alpine Pipeline," 16mm, Caterpillar Tractor Company, 1967

PAMPHLETS

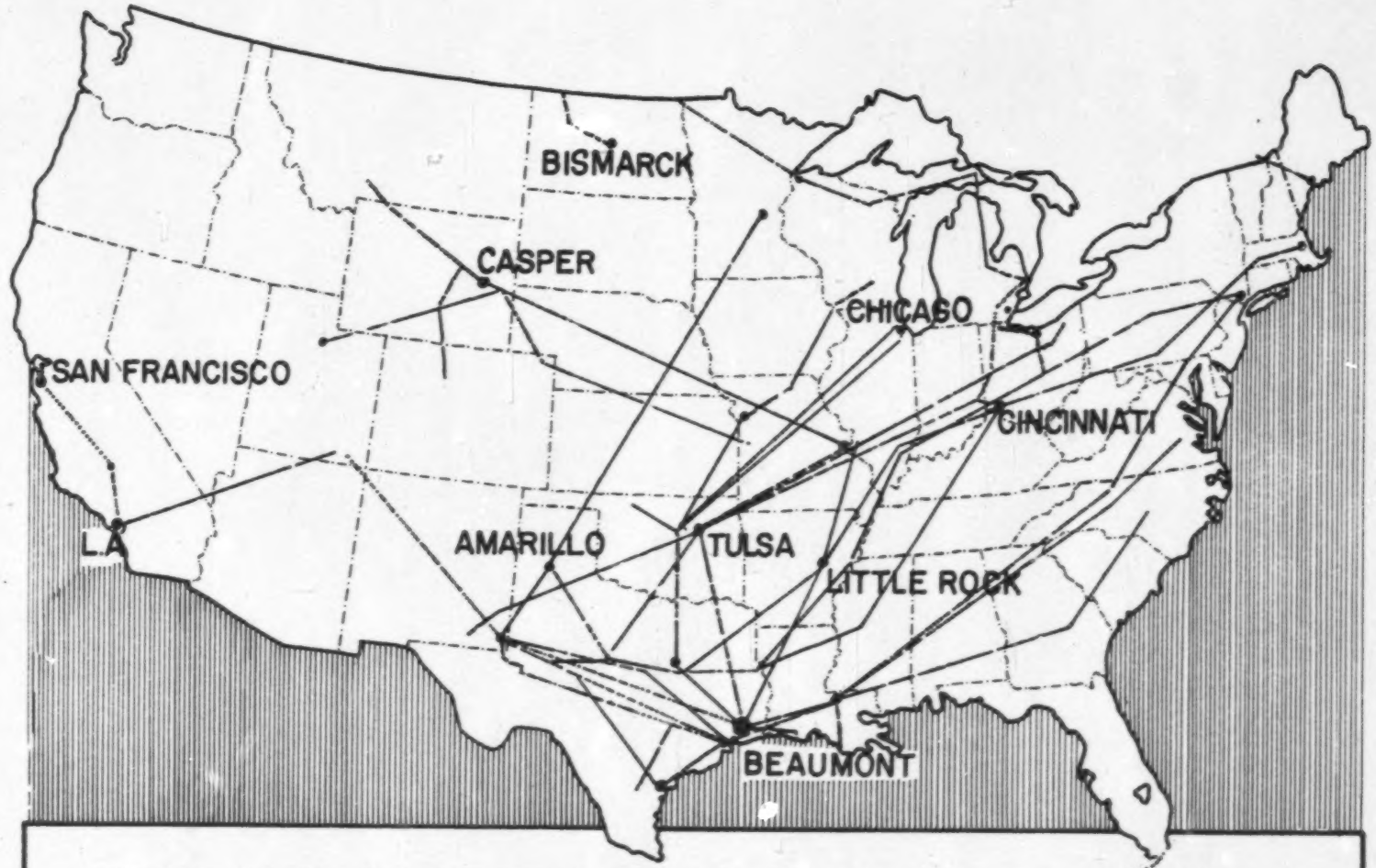
1. "A Few (kind) Words About Paperboard Packaging," American Paper Institute
2. "Careers for High School Graduates at International Harvester Company,"
3. "Drainage Pipe," Reynolds Metals Company
4. "Employment Outlook for Industrial Traffic Managers, Purchasing Agents," U.S. Department of Labor, Bureau of Labor Statistics
5. "Marketing," John Deere
6. "Oil Country Pipe," Reynolds Metals Company
7. "Packaging and the Pollution Problem," Pure-Pak
8. "Reynolds Aluminum Irrigation Pipe," Reynolds Metals Company

PHIPPS-STOUT : CURR. DEV. CNTR., U.K. 993-21



PIPELINE CONSTRUCTION

FAIRMORE C.D.C. GR 1256 T&I

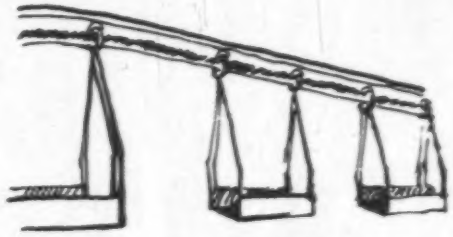


MAJOR CRUDE OIL & PETROLEUM PIPELINES OF THE UNITED STATES

R. GILMORE. CURR. DEVE. CNTR. UK. 9B3-2B

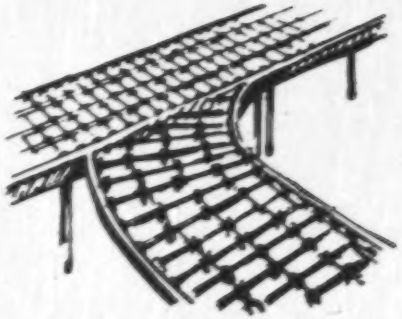
P.S. CURR. DEVE. CNTR. o.t. 111-26

TYPES OF CONVEYORS:

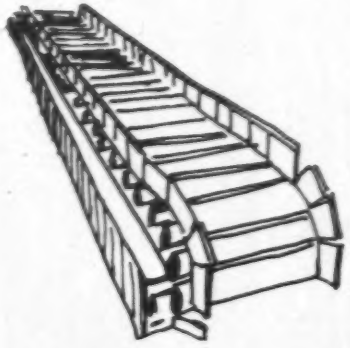


1. overhead monorail

2. gravity-operated roller

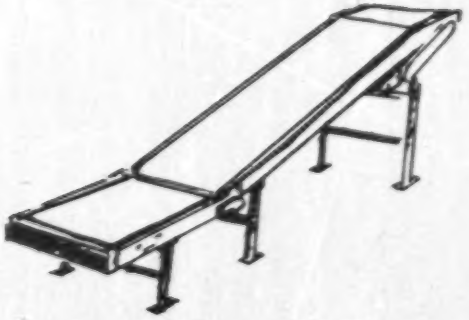


3. gravity-operated skatewheel



4. power - operated slat

5. gravity-operated portable



6. power - operated belt

WAREHOUSE TRANSPORTATION

APPENDIX

ADDRESSES OF PUBLISHERS AND DISTRIBUTORS

Aerospace Industries Association
1725 DeSales Street N.W.
Washington, D.C. 20036

Agricultural Engineering Center
Athens, Georgia 30601

Alabama State Docks
P.O. Box 1588
Mobile, Alabama 36601

American Airlines
633 Third Avenue
New York, New York 10017

American Gas Association
1515 Wilson Blvd.
Arlington, Virginia 22209

American Iron and Steel Institute
260 Madison Avenue
New York, New York 10016

American Heritage Publishing Company
1221 Avenue of Americas
New York, New York 10020

American Paper Institute
260 Madison Avenue
New York, New York 10016

American Petroleum Institute
1801 K Street N.W.
Washington, D.C. 20006

American Trucking Association
1616 P Street N.W.
Washington, D.C. 20036

Apollo Program Office
N.A.S.A.
400 Maryland Avenue S.W.
Washington, D.C. 20546

Association Sterling Films
866 Third Avenue
New York, New York 10022

Atlantic-Richfield
717 Fifth Avenue
New York, New York 10022

Belgian Embassy
3330 Garfield Street N.W.
Washington, D.C. 20008

Cahner Publishing
89 Franklin Street
Boston, Massachusetts 02110

Canadian Petroleum Association
404 6th Avenue S.W.
Calgary, Alberta, Canada

Caterpillar Tractor Company
Misc. Material Orders ABSC
100 N.E. Adams Street
Peoria, Illinois 61602

Cessna Aircraft Company
P.O. Box 1521
Wichita, Kansas 67201

Charles Merrill Publishing Co.
1300 Alum Creek Drive
Columbus, Ohio 43216

Childrens Press
1224 Van Buren Street W.
Chicago, Illinois 60607

Churchill Films
662 N. Robertson Blvd.
Los Angeles, California 90096

Corning-Glass Works
Corning, New York

Curtiss Wright
One Passaic Street
Wood Ridge, New Jersey

Delco-Remy
2401 Columbus Avenue
Anderson, Indiana 46011

Delta Nu Alpha Transportation Fraternity
15017 Detroit Avenue
Cleveland, Ohio 44107

Department of Army
Audio-Visual Support Center
Fort Meade, Maryland 20755

Department of Navy
5th Naval Dist.
U.S.N. Base
Norfolk, Virginia 23511

Dodd Publishers
79 Madison Avenue
New York, New York 10016

Doubleday Books
1003 Turkey Run Road
McLean, Virginia 22101

Doubleday Books
277 Park Avenue
New York, New York 10017

Eastern Espress Inc.
1450 Wabash Avenue
Terre Haute, Indiana 47808

Eastman Kodak Company
343 State Street
Rochester, New York 14650

Exxon Corporation
P.O. Box 2180
Houston, Texas 77011

F.A.A. Film Library
P.O. Box 25082
Oklahoma City, Oklahoma 73125

Federal Aviation Administration
806 15th Street
Washington, D.C. 20005

Field Enterprises Educational Corp.
510 Merchandise Mart Plaza
Chicago, Illinois 60654

Florida Department of Commerce
Collins Building
Tallahassee, Florida 32304

Follet Publishing Company
1010 W. Wash Blvd.
Chicago, Illinois 60607

Ford Motor Corporation
Dearborn, Michigan 48121

General Motors Film Library
Public Relations Staff
Detroit, Michigan 48202

Golden Press
Francestown, N.H. 03043

Grosset & Dunlap
51 Madison Avenue
New York, New Yorl 10010

Harcourt Publishing
755 Caldwell Avenue
Chicago, Illinois 60648

Harvey Publishing Company
Irvington-on-Hudson, New York

Humble Oil & Refinery Corp.
P.O. Box 2180
Houston, Texas 77001

Hutchinson Education Ltd.
299 Yorkland Blvd.
Willowdale, Ontario

Inland Steel Corporation
30 W. Monroe Street
Chicago, Illinois 60603

International Harvester
401 N. Michigan Avenue
Chicago, Illinois 60611

International Paper Company
220 E. 42nd Street
New York, New York 10017

Interstate Commerce Commission
Bureau of Accounts
12th & Constitution Avenue, N.W.
Washington, D.C. 20423

John Deere
Moline, Illinois 61265

Kaiser Aluminum
Kaiser Center
300 Lakeside Drive
Oakland, California 94604

Lake Carriers Association
1411 Rockefeller Bldg.
Cleveland, Ohio 44113

Library Films Inc.
1560 Broadway
New York, New York 10036

Lockheed Aircraft
Burbank, California 91503

Lockheed - Georgia Company
Zone 30, B-2 Bldg.
Marietta, Georgia 30060

McDonnel-Douglass Corporation
St. Louis, Missouri 63166

McGraw-Hill Book Company
1221 Avenue of Americas
New York, New York 10020

Massachusetts Institute of Technology
Cambridge, Massachusetts 02142

Mercedes Benz Film Library
295 W. 4th Street
New York, New York 10014

Modern Talking Picture Service
160 E. Grand Avenue
Chicago, Illinois

Modern Talking Picture Service
9 Garfield Place
Cincinnati, Ohio 45202

National Aerospace Education Asso.
Room 303
806 15th Street N.W.
Washington, D.C. 20005

National Aeronautics Space Admin.
400 Maryland Avenue S.W.
Washington, D.C. 20546

National Aeronautics Space Admin.
Langley Research Center
Public Affairs Office
Mail Stop 154
Hampton, Virginia 23365

National Asso. of Engine and
Boat Manufacturers
Film Library
295 W. 4th Street
New York, New York 10014

National Aviation Education Council
1025 Connecticut Avenue N.W.
Washington, D.C.

Ohio State University
Center for Vocational and
Technical Education
1900 Kenny Road
Columbus, Ohio 43210

Ohio State University Research
Foundation (NASA)
Hitchcock Hall, Room 316
2070 Neil Avenue
Columbus, Ohio 43210

Paul Hamlyn Ltd.
850 York Mills Road
Don Mills, Ontario M3B 3A7

Popular Library
355 Lexington Avenue
New York, New York 10017

Prentice-Hall, Inc.
Englewood Cliffs, New Jersey 07632

Pure-Pak
P.O. Box 03590
Highland Park, Michigan 48203

Reynolds Metals Company
6601 W. Broad Street
P.O. Box 27003
Richmond, Virginia 23226

Ringsby United
P.O. Box 192
Littleton, Connecticut 80120

Royal Netherlands Embassy
4200 Linnean Avenue N.W.
Washington, D.C. 20008

Scott, Foresman & Company
1900 E. Lake Avenue
Glenview, Illinois 60025

Southern Railway Company
P.O. Box 1808
Washington, D.C. 20013

Standard Oil of California
255 Bush Street
San Francisco, California 91420

Stanford University Graduate
School of Business
Stanford, California 94305

Tower Publishing, Inc.
New York, New York 10016

Union Oil Company of California
200 E. Golf Road
Palantine, Illinois 60067

United Airlines
P.O. Box 66100
Chicago, Illinois 60666

United Gas Pipeline Company
P.O. Box 1407
Shreveport, Louisiana 71158

U.S. Army Engineers District
Room 608
219 S. Dearborn Street
Chicago, Illinois 60604

U.S. Coast Guard
Public Information Division
Washington, D.C. 20226

U.S. Department of Transportation
400 7th Street S.W.
Washington, D.C. 20590

U.S. Government Printing Office
Washington, D.C. 20402

U.S. Steel Corporation
Education Services
600 Grant Street
Pittsburgh, Pennsylvania 15250

University of Illinois
Institute of Aviation
Urbana, Illinois

University of Kentucky Film
Library
Lexington, Kentucky 40506

Vanguard Press
424 Madison Avenue
New York, New York 10017

Vantage Press
516 W. 34th Street
New York, New York 10003

W.W. Norton & Company
55 Fifth Avenue
New York, New York 10003

Wayne State University (NASA)
5980 Cass
Detroit, Michigan 48202

Webster Division, McGraw-Hill
Book Company
1221 Avenue of Americas
New York, New York 10020

Wesleyan University Press
356 Wash Street
Middletown, Connecticut 06457